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Abstract

Using a gravity-type explanation of international trade flows at the industry level, it is shown that the pattern of comparative advantage in terms of sectoral export/import ratios in bilateral trade can be explained by relative income and relative per capita income. Total income of a country is a proxy of its economic size and has a positive effect on comparative advantage in most manufacturing industries (home market effect). Per capita income represents the capital-labour endowment ratio and demand conditions. In sum, it has a positive effect in (human) capital-intensive industries and a negative effect in labour-intensive industries.

Key words: Gravity model, comparative advantage, bilateral trade, home market effect, factor endowment

JEL classification: F 12

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I. Introduction

Trade theories identify two main sources of comparative advantage, namely differences in relative and absolute factor endowment. The traditional Heckscher-Ohlin-type models indicate that the commodity patterns of trade between two countries are shaped by relative factor endowment with given technologies and tastes (e.g. Deardorf 1982). The capital-rich country exports capital-intensive goods and imports labour-intensive goods. The new economic geography models, which allow for monopolistic competition, increasing returns to scale and transport costs, suggest that countries having identical relative endowments but differing in size, engage in interindustry trade with the larger country a net exporter in the increasing returns sector (Krugman 1980). This phenomenon is called the home market effect. Combining geography and factor-proportions theory, Bergstrand (1989) derives a gravity-type equation which predicts that the exports of a good in bilateral trade depend on income and per capita income of the two countries and the distance between them.

Convincing empirical tests of these theoretical arguments concerning the effects of factor endowment and size are rare, yield contradictory results, and refer to aggregated product groups. Tests of the factor-proportions theory mainly refer to the Heckscher-Ohlin-Vanek theorem on the factor content of trade and perform poorly in terms of volume and direction of net factor trade patterns (Trefler 1995). More plausible results have been achieved by using alternative assumptions on technology and considering distance between countries (Davis and Weinstein 1998a, Hakura 2001). Empirical evidence on the Heckscher-Ohlin-Vanek theorem's implication that net exports are a linear function of the factor endowment yields an unexpected negative impact of high-skilled labour on net exports of human capital-intensive goods (Leamer 1984 and updated by Song 1994). Gravity-type studies, disaggregated by product groups, have been limited to studies of trade among OECD countries. Moreover, empirical tests of the home-market hypothesis have not considered the effects of per capita income (Feenstra et al. 1998, Melchior 1998). Studies that include total income and per capita income have analysed exports *or* imports (e.g. Bergstrand 1989, Schumacher 1997, Fidrmuc 1998), but not exports *and* imports or their ratios to elaborate on the patterns of comparative advantage.

This paper compares exports and imports in bilateral trade using a gravity-type approach at the level of three-digit industries of the International Standard Industrial Classification (ISIC). It goes beyond the existing literature in three respects. Firstly, the analysis is disaggregated by more narrowly defined commodity groups and the interpretation is directly linked to the microeconomic foundations provided by Bergstrand (1989), combining both geography and

factor-proportions theory. Secondly, Bergstrand's analysis is developed further to determine the bilateral patterns of comparative advantage in terms of sectoral export/import ratios as a function of relative income and relative per capita income. Thirdly, a broader data base is used including trade with developing countries to cover a much wider range of income levels.

Section II summarises the microeconomic foundations of the "gravity equation" at the level of product groups and the empirical evidence so far available. Section III shows that the gravity-type approach implies a nonlinear relationship between the export/import ratios in bilateral trade, on one hand, and total income and per capita income on the other. Sections IV and V provide empirical results at the level of three-digit industries, firstly, for trade among OECD countries and, secondly, including trade with developing countries. The conclusions in section VI suggest that the empirical results, by and large, are in line with the model. Finally, directions for further research are outlined.

II. Theoretical Foundations of the Gravity Equation and Empirical Evidence

The gravity model, first advanced by Tinbergen (1962) and Linnemann (1966), assumes that bilateral trade is positively related to the two countries' incomes and negatively related to the distance between them. It proved successful in explaining empirically regional patterns of aggregated trade. In recent years, the gravity approach has gained new favour in the analysis of regionalisation trends in world trade[1] and in estimating potential trade flows with eastern Europe after the political and economic changes occurred in the region.[2]

The gravity equation is derived theoretically as a reduced form from a general equilibrium model of international trade in final goods. Formal analysis was provided by Anderson (1979), Krugman (1980), Bergstrand (1985) and Helpman and Krugman (1985) linking trade flows to exporter and importer incomes multiplicatively in models with differentiated goods. Feenstra et al. (1998) derived a gravity equation from a reciprocal-dumping model of trade with homogeneous goods and Deardorff (1998) showed that the gravity hypothesis is consistent with Heckscher-Ohlin trade in homogeneous goods and perfect competition. Baier and

[1] E.g. Frankel 1993, Saxonhouse 1993, Dhar and Panagariya 1994.

[2] Several studies consider trade at the aggregate level (e.g. Winters and Wang 1994, Baldwin 1994, Piazolo 1997), while others also provide analyses at the level of product groups (e.g. Festoc 1995, Vittas and Mauro 1997, Schumacher 1997, Fidrmuc 1998).

Bergstrand (2001) give an overview of the various theoretical foundations and show that they are complementary and special cases of a more general model.[3]

In these models, exporter and importer incomes are interpreted as their production and absorption capacities. Distance between them is taken as a proxy of trade costs. An important common feature of "economic geography models" with trade costs and monopolistic competition under increasing returns to scale is the "home market effect".[4] It appears as an elasticity of exports with respect to domestic income which exceeds the importing country's income elasticity. In a two-sector-model with trade costs and monopolistic competition, Krugman (1980) showed that large countries tend to be net exporters in the sector with monopolistic competition. Following these lines, Melchior (1998) demonstrated how home market effects may influence the trade pattern in a multi-country framework. Disaggregating by five major product groups, he found home market effects for chemicals as well as machinery and transport equipment, the opposite holds for primary commodities, whith resource based and light industry sectors being intermediate cases. Feenstra et al. (1998) arrived at similar results using a different approach, showing that the home market effect also characterises a homogeneous-product sector whith free entry. The effect is reversed if homogeneous goods have greater barriers to entry (e.g. due to resource-dependency). Applying a classification of goods suggested by Rauch (1999),[5] Feenstra et al. (1998) found a home market effect for differentiated goods, the reverse is true for homogeneous goods likely to be resource based and to have large entry barriers, and goods with reference prices lying between the two extremes.

Integrating the gravity equation into the factor-proportions theory of trade, Bergstrand (1989) extends the microeconomic foundations to include exporter and importer per capita incomes. Under a number of assumptions, he shows that the gravity equation is the reduced form of a general equilibrium model of bilateral trade among N countries with two differentiated-products industries and two factors of production. The coefficients are determined by the pa-

[3] "Specialization – and not new or old trade theory – generates the force of gravity." (Grossman 1998: 29). The reason for specialisation may be different, however, and may be related to product differentiation by country of origin (Armington-type import demand), economies of scale or factor endowment differences (Feenstra et al. 1998: 1). Evenett and Keller (1998) try empirically to separate between Heckscher-Ohlin theory and the Increasing Returns trade theory as driving forces behind the success of the gravity equation.

[4] Models with increasing returns and trade costs have come to be known as "economic geography", the phenomenon of unusually strong demand leading a good to be exported in a world of economic geography is known as the "home market effect" (Davis and Weinstein 1998b: 1/2). Davis (1998) shows that the relative trade costs for differentiated and homogeneous goods are crucial for the home market effect and that it disappears when the two kinds of goods have identical transport costs.

[5] He classified the goods as to whether they are (i) traded in an organised exchange, and therefore treated as "homogeneous", (ii) not traded in an organised exchange, but having some quoted "reference price", and (iii) not having any quoted prices, and therefore treated as "differentiated".

rameters of the demand and supply functions. They are negative for transport costs and protectionist measures and positive for GNP in the importing country and, if the elasticity of substitution in consumption exceeds one, for GNP in the exporting country. The exporter per capita income coefficient is positive for goods which are capital intensive in production and negative for labour-intensive goods.[6] The importer per capita income coefficient is positive for goods which are ”luxury” in consumption and negative for “necessities”. Thus, the coefficients of per capita GNP can be used to rank the industries (i) by their capital intensity in production and (ii) by their characteristics in import demand.

A relatively small number of studies applying the gravity model at the level of product groups are available. Empirical evidence is to be found in Bergstrand (1989) and Fidrmuc (1998) for one-digit groups of the Standard International Trade Classification (SITC), in Vittas and Mauro (1997) and Festoc (1997b) for selected two-digit SITC categories. The studies refer to trade among EU member countries or to a larger sample of OECD countries. The results differ, depending on the year and the sample of countries. The values of the exporter per capita income elasticities suggest that machinery and transport equipment, chemicals, raw materials and fuels are capital intensive in production whereas miscellaneous manufactures, in particular clothing, are labour intensive. The importer per capita income elasticities suggest that miscellaneous manufactures, manufactures by material and food tend to be luxuries in consumption whereas chemicals, raw materials and fuels tend to be necessities.

This paper applies a gravity model in the spirit of Bergstrand (1989) to a more comprehensive data set which captures the bilateral trade flows between the OECD countries and a large number of partner countries broken down by three-digit industries of the International Standard Industrial Classification (ISIC Rev. 2). The analysis reveals differences between product groups which cannot be seen at a more aggregate level. It covers both total and per capita income and emphasises their impact on the ratio of exports to imports. Our approach is described in the next section.

III. Income, Per Capita Income and Comparative Advantage: The Model

The gravity equation in log-form is given by

[6] This strictly holds for two goods; in the multi-industry case “a weak inference of the relative factor intensity of the industry can be made using exporter per capita income coefficient estimates from a gravity equation”

$$\ln X_{aij} = \beta_0^a + \beta_1^a \ln Y_i + \beta_2^a \ln y_i + \beta_3^a \ln Y_j + \beta_4^a \ln y_j + \beta_5^a D_{ij} + \sum_{k=6}^{K} \beta_k^a Z_{kij} \qquad (1)$$

X_{aij} is the value of the trade flow in industry a from country i to country j (i,j = 1, ..., N). Y_i is i's national output; following the interpretation in Bergstrand (1989), it is expressed in terms of units of capital.[7] It represents the supply capacity of the exporting country in terms of capital stock and is proxied by GNP. y_i is i's capital-labour endowment ratio which is proxied by i's GNP per capita. Y_j and y_j are j's GNP and GNP per capita, respectively. The bilateral trade costs are represented by distance D_{ij} between the economic centers of the respective countries, supplemented by a dummy for adjacency. The other dummy variables Z_{kij} are proxies for trade policy measures and other factors which may be important for market access such as membership in preference zones, common language or historical ties.

The intersectoral division of labour in bilateral trade can be determined by comparing the exports and imports given by the gravity approach. Equation (1) simultaneously determines exports and imports in bilateral trade. X_{aij} represents the value of exports in industry a from country i to country j. The reverse flow, i.e. the imports of industry a's goods by country i from country j, is given by the same equation replacing i by j and vice versa:

$\ln M_{aij} = \ln X_{aji}$ and

$$\ln X_{aji} = \beta_0^a + \beta_1^a \ln Y_j + \beta_2^a \ln y_j + \beta_3^a \ln Y_i + \beta_4^a \ln y_i + \beta_5^a D_{ji} + \sum_{k=6}^{K} \beta_k^a Z_{kji} \qquad (2)$$

Subtracting (2) from (1) gives the log-form of the export/import ratio in bilateral trade of good a. Because $D_{ji} = D_{ij}$ and $Z_{kji} = Z_{kij}$, the log difference between exports and imports is

$$\ln X_{aij} - \ln X_{aji} = (\beta_1^a - \beta_3^a)(\ln Y_i - \ln Y_j) + (\beta_2^a - \beta_4^a)(\ln y_i - \ln y_j) \qquad (3a)$$

or, in non-log form, the export/import ratio is

$$\frac{X_{aij}}{X_{aji}} = \left(\frac{Y_i}{Y_j}\right)^{\beta_1^a - \beta_3^a} \left(\frac{y_i}{y_j}\right)^{\beta_2^a - \beta_4^a} \qquad (3b)$$

(Bergstrand 1989: 146, referring to Deardorff 1982 who provided a "weak" generalisation of the Heckscher-Ohlin theorem by proving that countries tend to export those goods which use intensively their abundant factor).

[7] "Capital" in our context includes tangible and intangible assets. Human capital endowment is highly correlated with GNP per capita and, next to natural resources, it is the decisive factor in determining the sectoral structure of a country's comparative advantage (Wood 1994a and b). This holds particularly for the division of labour between industrial and developing countries, but also for the intersectoral division of labour among industrial countries (e.g. Schumacher 1992).

and depends on the ratio of the two GNPs and the ratio of the two per capita incomes. Distance and dummy variables representing trade preferences among selected countries do not affect the ratio of exports to imports. According to equations (1) and (2), they have the same effect on the bilateral exports and imports and, therefore, they are relevant for the volume of trade and determine the amount of intra-industry trade. They do not, however, have an impact on the pattern of inter-industry specialisation in bilateral trade.

The pattern of comparative advantage between each pair of countries can be described by relating the export/import ratios in the individual industries to the export/import ratio of all manufactures or all goods combined (indicator of revealed comparative advantage: RCA). In log-form the RCA values are given by

$$\begin{aligned}&\left(\ln X_{aij} - \ln X_{aji}\right) - \left(\ln X_{oij} - \ln X_{oji}\right)\\ &\quad = \left[\left(\beta_1^a - \beta_3^a\right) - \left(\beta_1^o - \beta_3^o\right)\right]\left(\ln Y_i - \ln Y_j\right)\\ &\quad + \left[\left(\beta_2^a - \beta_4^a\right) - \left(\beta_2^o - \beta_4^o\right)\right]\left(\ln y_i - \ln y_j\right)\end{aligned} \tag{4}$$

where the subscript or superscript, respectively, “o” indicates the coefficients for all manufactures or all goods, respectively.

If the two countries i and j have the same per capita income, comparative advantage only depends on relative size. The export/import ratio in equation (3a) or (3b) and the relative ratio in equation (4) increases with higher β_1^a and lower β_3^a indicating a positive effect on comparative advantage arising from the large size of a country as compared to smaller countries. The difference

$$\beta_1^a - \beta_3^a \tag{5}$$

gives the elasticity of good a’s bilateral export/import ratio with respect to the relative total income of the exporting country i at constant per capita income, ie. with respect to total factor endowment. A positive value of (5) indicates a home market effect which may arise because producers can exploit higher economies of scale in the larger market. Following Krugman (1980), Melchior (1998) and Feenstra et al. (1998), we would expect that the size of the exporting country will be more important than the size of the importing country for differentiated goods in manufacturing whereas the opposite will hold for homogeneous goods such as raw materials or resource-intensive products. We would also expect that the home market effect plays a more important role in industries with high economies of scale.

If the two countries have the same economic size, the pattern of comparative advantage in bilateral trade is only shaped by supply and demand conditions which are related to per capita income. The export/import ratio in equation (3a) or (3b) and the relative ratio in equation (4) is larger the larger β_2^a and the smaller β_4^a, i.e. the more the respective good is capital intensive in production and the more it is necessity in consumption, and it is smaller the smaller β_2^a and the larger β_4^a, i.e. the more the respective good is labour intensive in production and the more it is luxury in consumption. The difference of the two coefficients

$$\beta_2^a - \beta_4^a \tag{6}$$

gives the elasticity of good a's bilateral export/import ratio with respect to the relative per capita income of the exporting country i at constant overall income, i.e. with respect to relative factor endowment. Ranking the industries by the value of (6) should describe the typical intersectoral division of labour between high-income and low-income countries. The pattern is more pronounced, the larger the divergence of per capita income in country i over per capita income in country j.

IV. Empirical Results for Trade among OECD Countries

As a first step, we apply equation (1) to explain the bilateral shipments among 22 OECD countries,[8] as well as equations (3a) and (4) to determine the effects of relative total income and relative per capita income on the export/import ratios. The regressions are calculated for the average annual trade flows of the years 1988 to 1990 (in US-$ million) for all products combined, agriculture, mining and quarrying, manufacturing products as a whole and broken down by 25 three-digit ISIC industries.[9] For this purpose the OECD foreign trade figures are appropriately recoded from the original SITC categories.

As to the explanatory variables the data on GNP (in US-$ million) and GNP per capita (in US-$) are taken from World Bank publications and refer to 1989.[10] The distance D_{ij} (in miles)

[8] Member countries in 1993, excluding Iceland and taking Belgium/Luxembourg together.

[9] A similar approach and the data are also described in Schumacher (1997a) which gives empirical results for all goods, as well as manufacturing products as a whole and broken down by high, medium and low-tech products.

[10] World Development Indicators. GNP figures are calculated by multiplying GNP per capita and population figures. All values are at current prices and exchange rates.

between the countries i and j is calculated as the shortest line between their economic centres EC_i and EC_j by latitudinal and longitudinal position[11]. The dummy variables cover

- adjacency (ADJ_{ij})
- membership in a preference area: European Union (EU_{ij}), European Free Trade Agreement ($EFTA_{ij}$), Free Trade Agreement between the USA and Canada ($CUSTA_{ij}$) and Asia-Pacific Economic Cooperation ($APEC_{ij}$),
- ties by language (LAN_{ij}) and
- historical ties (COL_{ij}).

The value of the dummy variable is 1, if the two countries i and j have a common land border, belong to the respective preference zone, or have the same language[12] or historical ties.[13] Otherwise the value of the variable is zero.

For estimating the regression coefficients, we apply an OLS procedure on the log-linear form of the gravity equations replacing zero trade flows by a very small figure.[14] Zero values, in general, do not occur in trade among OECD countries at the aggregate level. A number of bilateral trade flows are, however, zero if the figures are disaggregated by product groups and/or include developing countries. In principle a Tobit estimator taking proper account of zero values would be more appropriate. In similar applications of a gravity equation, however, the Tobit results are very similar to the OLS estimator, where zero values are replaced by a very small figure.[15]

The complete results of the regressions describing the bilateral trade flows among OECD countries are presented in Tables A.1 and A.2 in the Appendix. Table A.1 is based on export statistics and Table A.2 refers to import statistics. Both statistics represent the same flows, the

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[11] In principle, the national capitals were taken as the economic centre except for Canada (Montreal), the United States (Kansas City as a geographical compromise between the centres of the East and West Coasts), Australia (Sydney), West Germany (Frankfurt/Main), Brazil (Rio de Janeiro), Pakistan (Karachi), and India (Bombay). The formulae are:

$\cos D_{ij} = \sin \varphi_i \cdot \sin \varphi_j + \cos \varphi_i \cdot \cos \varphi_j \cdot \cos (\lambda_j - \lambda_i)$

$D_{ij} = \arccos (\cos D_{ij}) \cdot 3962.07$ miles

for $EC_i = (\varphi_i; \lambda_i)$ and $EC_j = (\varphi_j; \lambda_j)$ with φ = latitude, λ = longitude.

[12] 0.5 for second languages.

[13] 0.5 for ties until 1914.

[14] Adding 0.001 US-$ million. This is the smallest unit recorded in international trade statistics.

[15] See Baldwin (1994: 85) and Wang and Winters (1991: 119).

values are, however, different, but the results are very similar.[16] The explanatory power of the model is strong as it is common for gravity equations for total trade. The R^2 for all goods and all manufactures is 0.9, in the individual sectors range from a minimum of 0.5 to 0.6 in mining, agriculture, wood products and petroleum products to a maximum of 0.8 and higher in precision engineering goods, machinery, metal products, plastic products and printing goods. By and large, the results show the expected pattern with regard to sign and significance of the coefficients. The higher the national product of countries and the smaller the geographical distance between them, the greater the merchandise flows between them. Membership of APEC and of the EU in general has a positive impact on exports and imports. The same is true for relationships in terms of language and historical ties. The impact of a common border too, is mostly positive as might be expected; it is, however, less significant than in other studies.

The estimated *income elasticities* as well as the difference between exporter and importer income elasticities giving the impact on the export/import ratio are presented in Table 1 and in Figure 1. In the Figure, the difference is represented by the vertical distance between the sectoral point and the 45° line and it is positive (negative) for sectors above (below) that line for which $\beta_1^a - \beta_3^a = 0$. It is negative only in food, paper, non-ferrous metals and mining goods, i.e. primary or resource-intensive goods confirming the results of Feenstra et al. (1998) and Melchior (1998). For manufactured goods as a whole the difference is zero whereas for most manufactures it is positive indicating a significant home market effect. As distinct from Melchior (1998) we also find a home market effect for consumer goods. The effect is largest for rubber, transport equipment, pottery and footwear. Except for transport equipment there is no correlation with the ranking of manufacturing sectors according to the level of economies of scale. Following a compilation in Junius (1999: 74/75) the highest levels of economies of scale should be realised in motor vehicles and other transport equipment, chemicals, metals, machinery and precision engineering. They should be lowest or nonexistent in the branches of leather and leather goods, footwear and clothing, timber and wood as well as the textile industry.

[16] One reason for different export and import figures is the c.i.f. valuation of imports versus f.o.b. valuation of exports which tends to increase the value of imports in line with distance. The absolute values of the distance elasticity are, therefore, lower for import values than for export values. Other reasons are different recording by time, partner countries or product groups which may account for much larger divergences between the export and import values than the c.i.f. margins. Despite these divergences the regression results for the export and import statistics of intra-OECD trade are by and large consistent. The standard error is somewhat lower using the import statistics.

The estimated per capita income elasticities are compiled in Table 2 and displayed in Figure 2. The *exporter per capita income elasticities* indicate that food, wood products, furniture, paper, printing, chemicals, plastic products, non-ferrous metals, metal products, machinery, electrical goods, transport equipment, precision engineering goods and other manufactured goods are capital intensive in production ($\beta_2^a > 0$). On the other hand, agricultural products, textiles, wearing apparel, footwear, pottery, glass and structural clay products tend to be labour intensive ($\beta_2^a < 0$). The same result holds for mining and petroleum products, which does not seem to be reliable. As for the characteristics of demand the *importer per capita income elasticity* indicates that wearing apparel, footwear, wood products, furniture as well as printing, rubber and plastic products, pottery, glass, metal products and other manufactures are luxuries ($\beta_4^a > 0$), whereas industrial chemicals as well as iron and steel tend to be necessities in consumption ($\beta_4^a < 0$). Manufacturing goods as a whole are capital intensive no effect arising from the demand side.

Taking both sides together we can identify the impact of relative per capita income on the export/import ratios in bilateral trade by the difference of the two elasticities $\beta_2^a - \beta_4^a$. These differences and, for manufacturing industries, the deviations from total manufacturing are also presented in Table 2. In Figure 2 the differences are given by the vertical distance between the individual points and the 45° line for which $\beta_2^a - \beta_4^a = 0$. The effect of relative per capita income on the export/import ratio is positive (negative) for those sectors which lie above (below) that line. The deviations from total manufacturing are given by the vertical distance between the sectoral point and the broken line for which $\beta_2^a - \beta_4^a$ is equal to that difference for manufacturing goods as a whole.

Relative per capita income has a positive impact on the bilateral export/import ratio for all goods and for manufacturing as a whole. This finding is in line with traditional theory suggesting a net capital export from the capital-rich high income country to the capital-poor low income country due to higher capital productivity in the low income country. Within manufacturing the comparative advantage of a high income OECD country in trade with an OECD country at a lower level of income tends to be in those product groups for which the difference is larger than for total manufacturing, i.e. for which $\beta_2^a - \beta_4^a >$ 0.35 or 0.3, respectively. These sectors lie above the broken line in Figure 2. On the other hand, higher income countries tend to have comparative disadvantage in the product groups below the broken line. The largest comparative advantage is in paper products, precision engineering, machinery, chemi-

cals, non ferrous metals, transport equipment and electrical machinery. The strongest disadvantage of a relatively rich country is in wearing apparel, footwear, pottery, textiles, glass and structural clay products. In industrial chemicals, both production and consumption characteristics contribute to the comparative advantage (capital-intensive necessities), in wearing apparel, footwear, pottery and glass both sides contribute to the comparative disadvantage (labour-intensive luxuries). For wood and plastic products the positive effect of capital intensity on comparative advantage is diminished by demand characteristics, in furniture the net effect is even negative because the demand side outweighs the supply side (capital-intensive luxuries).

All in all, the direction of comparative advantage in bilateral trade among OECD countries is determined more by production characteristics than by demand conditions. As compared to the effect of relative total income the effect of relative per capita income in capital-intensive industries goes in the same direction, i.e. it is positive in both cases. In labour-intensive industries it is different, relative per capita income having a negative effect and relative income a positive one.

V. Empirical Results Including Trade with Developing Countries

As a second step we extended the sample to developing countries to cover a broader range of income levels. The data on trade among developing countries is not sufficiently disaggregated by product groups and, therefore, cannot be recoded according to the sectoral breakdown used in this paper. By only using the foreign trade data of OECD countries we have to determine the exports and imports separately. Thus, the approach is no longer "symmetric" in the sense that the number of exporting and importing countries i and j is the same. On the other hand, we can take account of the fact that the product groups may not be homogeneous for exports and imports.[17]

On these grounds, we formulate the following approach for estimating the "normal" pattern of exports and imports of the OECD countries:

[17] Exports and imports in the same product group may be heterogeneous, in particular for trade between high and low income countries. Firstly, the commodity patterns within a product group are different (see Schumacher 1983). Secondly, even in most narrowly defined product groups there is a large amount of vertical product differentiation, low income countries tending to supply high shares of the low price and low quality segment, whereas high income countries tend to specialise more in the high price and high quality segment (see Freudenberg and Trabold 1999).

$$\ln X_{aij} = \beta^a_{ox} + \beta^a_{1x} \ln Y_i + \beta^a_{2x} \ln y_i + \beta^a_{3x} \ln Y_j + \beta^a_{4x} \ln y_j + \beta^a_{5x} \ln D_{ij} + \sum_{k=6}^{K} \beta^a_{kx} Z_{kij} \quad (7)$$

and

$$\ln M_{aij} = \beta^a_{om} + \beta^a_{1m} \ln Y_i + \beta^a_{2m} \ln y_i + \beta^a_{3m} \ln Y_j + \beta^a_{4m} \ln y_j + \beta^a_{5m} \ln D_{ij} + \sum_{k=6}^{K} \beta^a_{km} Z_{kij} \quad (8)$$

The subscripts x and m indicate whether the coefficients refer to exports or imports of the OECD countries; i = 1, ..., 22 and j = 1, ..., 70. The regressions are computed on the basis of the annual average of the bilateral trade flows for the years 1988 to 1990 between 22 OECD countries and 70 countries, including the OECD countries and 48 developing countries. The developing countries were selected on the basis of their volume of total foreign trade with the OECD countries and whether data for all variables was available. Thus, the coefficients are to represent the average characteristics of OECD countries' trade with economies ranging from high levels of per capita income to very low income levels.

Except for the OECD countries the countries considered in the analysis are represented as buyers only in the export equation and as suppliers only in the import equation. The coefficients of the same variable will therefore be different for exports and for imports. Here, the export/import ratios in bilateral trade are determined by subtracting equation (8) from equation (7). The RCA values (in log) describing comparative advantage within manufacturing are the difference for the individual product groups minus the same difference for all manufactures and can therefore be expressed as a linear function of the same exogeneous variables. Thus, the bilateral pattern of comparative advantage is a function of income and per capita income in the two countries concerned, geographical distance and the various dummy variables. We estimated equations (7) and (8), as well as their difference and the RCA values of manufacturing industries.

The impact of the individual variables on the export/import ratios is given by the difference of the respective coefficients for exports and imports. Thus, the change of the ratio arising from changes in income and per capita income of OECD country i is given by

$\beta^a_{1x} - \beta^a_{1m}$ and $\beta^a_{2x} - \beta^a_{2m}$, respectively

while the impact of income and per capita income of partner country j is

$\beta^a_{3x} - \beta^a_{3m}$ and $\beta^a_{4x} - \beta^a_{4m}$, respectively.

The impact of income in the two countries i and j on the export/import ratio is the same in quantitative terms only in the "symmetric" case of equations (1) and (2) and then can be described as a function of the ratio of the two (per capita) incomes according to equation (3a) or (3b). In the "asymmetric" case of equations (7) and (8) the net effect arising from higher relative income or relative per capita income, respectively, is divided into two parts (i) the effect arising from higher (per capita) income measured over the 22 OECD countries and (ii) the effect arising from lower (per capita) income measured over the 70 partner countries comprising a much broader range of income levels. We now have two home market effects and two classifications of goods according to production and consumption characteristics. The results are, therefore, not strictly comparable to those discussed above for trade among the 22 OECD countries only.

The complete results of the regressions describing the OECD countries' bilateral trade flows with 70 countries are presented for exports and imports, respectively, in Tables A.3 and A.4 in the Appendix. The elasticities of OECD and partner countries' income as well as the net effects on the export/import ratios and the RCA values within manufacturing are compiled in Table 3 and presented in Figure 3. Following $\beta_{1x}^{a} - \beta_{1m}^{a}$ the impact of the *OECD countries' income* on the export/import ratio is significantly positive in a large number of manufacturing industries. The ranking of manufacturing industries by the difference of income elasticities is similar to the ranking for trade among OECD countries (Spearman's rank correlation coefficient r = 0.8). Following $\beta_{3x}^{a} - \beta_{3m}^{a}$ the *partner countries' income* has a negative impact on the OECD country's export/import ratio in nearly all manufacturing industries indicating a significant home market effect in the partner countries. The ranking of manufacturing sectors according to the results over the 70 countries is different from the results over the 22 OECD countries and for trade among the OECD countries (r = 0.4). In all cases, rubber and transport equipment show a very high home market effect whereas the reverse is true for food, non-ferrous metals and wood products.

Table 4 and Figure 4 give the elasticities of OECD exports and imports with respect to per capita income in OECD and partner countries, as well as the effects on the export/import ratio and on the RCA value for manufacturing industries. The signs of the elasticities of exports and imports with respect to *GNP per capita in the OECD countries* (β_{2x}^{a} and β_{2m}^{a}) by and large follow the distinction between capital-intensive versus labour-intensive goods in production and between luxury and necessity goods in consumption, respectively, described above for trade among OECD countries. The elasticities of exports and imports with respect to *GNP per*

capita in the partner countries (β_{4x}^{a} *and* β_{4m}^{a}) show a different picture. β_{4x}^{a} represents the characteristics of consumption for OECD exports over 70 importing countries and is mostly positive, i.e. OECD exports in most product groups increase with per capita income of the partner country (luxuries). It is negative only for industrial chemicals, petroleum products, as well as iron and steel (necessities). β_{4m}^{a} representing the characteristics of production for OECD imports over 70 supplier countries is significantly negative for agricultural products, leather products and footwear (labour-intensive goods) and it is positive for most other product groups (capital-intensive goods). The effects on the export/import ratios from a higher income level in the OECD country and a lower income level in the partner country go into the same direction in most product groups.

In sum, the cross-section results over 70 countries with a broader range of per capita income at a lower average level largely confirm the results for the group of OECD countries with a smaller range of per capita income at a higher average level. This is true with regard to the home market effect which is again significant in most manufacturing industries. Moreover, the ranking of products according to both their characteristics in production and their characteristics in consumption is very similar in all estimations, although the coefficient values may be different. Spearman's rank correlation coefficients are always very high, ranging from 0.7 to nearly 1. Consequently, the same is true for the ranking of manufacturing products according to the effect of per capita income on comparative advantage. This is shown in Figures 5 to 7. In Figures 5 and 6 the sectoral pattern of export/import ratios in manufacturing trade among OECD countries is presented as a function of relative GNP per capita in logs; the slope of the straight lines is given by the difference $\beta_{2}^{a} - \beta_{4}^{a}$. The pattern is more spread out for larger ratios of the per capita income and it is "flatter" for smaller ratios. Similarly, Figure 7 shows the effect on the pattern of comparative advantage of an OECD country in manufacturing trade with 70 countries arising from higher per capita income in the OECD country (on the right hand side) and from lower income in the partner country (on the left hand side).

The border line between the various categories of goods is, however, different. Over a broader range of per capita income at a lower average level more product groups are "capital intensive" and "luxuries" increasing the exports and imports with increasing per capita income. This seems to be plausible because, firstly, as compared with a smaller average endowment with capital relative to labour more goods appear capital intensive and, secondly, at a lower average income level more goods appear luxury. Consequently at the higher average income level of OECD countries we find a larger number of "labour-intensive" goods and "necessi-

ties" decreasing the exports and imports with increasing per capita income. Moreover, the pattern of comparative advantage for trade among OECD countries is mainly shaped by supply characteristics whereas as measured over 70 countries the demand conditions play an important role, too. In all cases, there is a negative correlation between the ranking of sectors by supply and demand characteristics which is significant, however, only over the 70 countries (r = - 0.6). This means that goods tend to be both capital intensive in production and necessity in demand or both labour intensive and luxury, i.e. the effects of the two sides on the export/import ratio largely add up.

VI. Conclusions

Applying the gravity model at the level of individual product groups simultaneously permits the explanation of regional and sectoral patterns of a country's external trade. This is a considerable advance over the traditional procedure of explaining sectoral patterns and regional patterns independently of each other. If a theory of external trade is to be empirically tested in a successful fashion, neither of the two dimensions can be excluded using 'ceteris paribus'. This becomes immediately clear if, for example, one compares countries such as Germany and Japan, which have a similar factor endowment and the same level of per capita income. Because Japan lies close to countries at a lower stage of development, whereas most of Germany's neighbouring countries have a comparable level, Japanese and German commodity patterns of total foreign trade differ considerably.

The integrated approach implies an explanation of the sectoral export/import ratios in bilateral trade as a nonlinear function of the relative income and per capita income of the two countries concerned. *Total income* represents the market size which has a positive effect on comparative advantage in most manufacturing industries whereas it has no or even a negative effect in raw materials and in resource-intensive goods. This finding largely confirms the results of other studies on the home market effect. As distinct from these studies which do not consider per capita income separately we also find a home market effect for labour-intensive goods. The income elasticities in other tests may partly reflect the impact of per capita income reinforcing the effect in the (capital-intensive) investment goods industries and diminishing the effect in the (labour-intensive) consumer goods industries.

The effect of *per capita income* represents the degree of capital intensity versus labour intensity of the goods in production and the degree of luxury versus necessity in consumption, respectively. Here, our empirical results are weaker for raw materials and several raw material

intensive goods, whereas the model performs well and gives consistent results for manufacturing products for which the endowment with (human) capital versus labour is the most important factor of competitiveness. In trade among OECD countries the pattern of comparative advantage is mainly shaped by the factor intensity in production, in trade including developing countries also the characteristics of demand play an important role and tend to strengthen the effect of the supply side. All estimations yield similar rankings of product groups, but the border line between the various categories of goods differs depending on the sample of countries. All in all, the strongest comparative advantage of high income countries is in paper products, industrial and other chemicals, non-ferrous metals, machinery, electrical goods, transport equipment and precision engineering goods. Low income countries have the highest comparative advantage in textiles, wearing apparel, footwear and pottery. The sectoral pattern of comparative advantage and disadvantage is more pronounced with larger differences in income levels.

These findings are in line with the "stages approach" to comparative advantage (Balassa 1984) which suggests that the factor endowment depends on the level of development measured by per capita income. Less developed countries have a smaller capital stock per capita than more developed countries and therefore exchange labour-intensive goods for capital-intensive goods. Alongside with per capita income the capital endowment is growing and therefore, with increasing level of development the export of capital-intensive goods is growing as well. Thus, intra-industry trade increases and the RCA pattern becomes "flatter".

Our findings also explain why a country may have different comparative advantage in bilateral trade depending on the per capita income of the partner country: The trade of developing countries with developed countries is characterised by the export of labour-intensive goods whereas capital-intensive goods play a more important role in trade with other developing countries (Havrylyshyn and Wolf 1981). For the central and eastern European countries in transition too, the RCA pattern in trade with developing countries differs from that in trade with western industrialised countries (Trabold 1996).

Further research may improve the sectorally disaggregated gravity-type approach in various respects. The model should be extended to cover additional factors of production, e.g. natural resources, as well as human and physical capital separately. Further disaggregation may give more homogeneous product groups, and trade among non-OECD countries should be integrated into the empirical analysis. As a result the number of zero values can be expected to grow, increasing the necessity to apply an estimation procedure for limited dependent vari-

ables. Finally, it may be asked whether the vertical differentiation by price and quality segments within product groups follows a similar pattern of explanation as the intersectoral division of labour analysed here. Theoretical arguments and empirical evidence suggest that high income countries tend to specialise in the high price and quality segments whereas low income countries tend to supply high shares of the low price and low quality segment.

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Table 1

Income elasticities: Results for three-digit industries for trade among 22 OECD countries 1988-90

	Product groups	Export statistics				Import statistics			
		Shipments				Shipments			
		Income of the exporting country i	Income of the importing country j	Export/ import ratio	RCA value	Income of the exporting country i	Income of the importing country j	Export/ import ratio	RCA value
	(ISIC Rev.2)	β^a_1	β^a_3	$\beta^a_1 - \beta^a_3$	1)	β^a_1	β^a_3	$\beta^a_1 - \beta^a_3$	1)
0	All products	0.75 **	0.78 **	-0.03		0.74 **	0.75 **	-0.01	
1	Agriculture	0.79 **	0.86 **	-0.07		0.72 **	0.77 **	-0.05	
2	Mining and quarrying	1.01 **	1.08 **	-0.06		0.86 **	1.01 **	-0.16 *	
3	Manufacturing	0.76 **	0.78 **	-0.02	0.00	0.76 **	0.74 **	0.02	0.00
31	Food, beverages, tobacco	0.37 **	0.85 **	-0.48 **	-0.46 **	0.36 **	0.82 **	-0.46 **	-0.48 **
321	Textiles	0.74 **	0.68 **	0.06	0.08 *	0.73 **	0.60 **	0.13 **	0.11 **
322	Wearing apparel	0.98 **	0.81 **	0.17 **	0.19 **	0.99 **	0.69 **	0.30 **	0.28 **
323	Leather and leather products	0.92 **	0.99 **	-0.07	-0.05	0.89 **	0.90 **	-0.01	-0.03
324	Footwear	1.09 **	0.69 **	0.39 **	0.41 **	1.13 **	0.64 **	0.48 **	0.46 **
331	Wood and wood products	0.55 **	0.68 **	-0.13	-0.11	0.57 **	0.66 **	-0.09	-0.11
332	Furniture	0.87 **	0.90 **	-0.03	-0.01	0.88 **	0.80 **	0.08	0.06
341	Paper and paper products	0.63 **	0.80 **	-0.17	-0.15	0.63 **	0.80 **	-0.18 *	-0.20 **
342	Printing and publishing	1.10 **	0.76 **	0.34 **	0.35 **	1.09 **	0.69 **	0.40 **	0.38 **
351	Industrial chemicals	1.01 **	0.90 **	0.11 *	0.13 **	0.91 **	0.90 **	0.01	-0.01
352	Other chemical products	0.93 **	0.78 **	0.15 **	0.16 **	0.97 **	0.72 **	0.25 **	0.23 **
353/4	Petroleum refineries and prod.	1.31 **	1.20 **	0.12	0.13	1.39 **	1.25 **	0.14	0.12
355	Rubber products	1.27 **	0.69 **	0.58 **	0.59 **	1.24 **	0.67 **	0.57 **	0.55 **
356	Plastic products	0.76 **	0.63 **	0.12 **	0.14 **	0.79 **	0.58 **	0.21 **	0.19 **
361	Pottery, china and earthware	1.37 **	0.90 **	0.47 **	0.49 **	1.31 **	0.86 **	0.45 **	0.43 **
362	Glass and glass products	1.21 **	0.91 **	0.30 **	0.32 **	1.22 **	0.81 **	0.42 **	0.40 **
369	Structural clay products	1.10 **	0.85 **	0.26 **	0.27 **	1.05 **	0.88 **	0.17 **	0.15 **
371	Iron and steel basic industr.	1.11 **	1.02 **	0.08	0.10	1.06 **	0.96 **	0.10	0.08
372	Basic non ferrous metals	0.91 **	1.07 **	-0.16 *	-0.14 *	0.82 **	0.99 **	-0.17 **	-0.19 **
381	Fabricated metal products	0.86 **	0.76 **	0.11 **	0.12 **	0.86 **	0.70 **	0.16 **	0.14 **
382	Machinery (excl. electrical)	0.96 **	0.75 **	0.22 **	0.24 **	1.00 **	0.70 **	0.30 **	0.28 **
383	Electrical machinery	1.02 **	0.70 **	0.32 **	0.34 **	1.04 **	0.67 **	0.36 **	0.34 **
384	Transport equipment	1.47 **	0.91 **	0.56 **	0.58 **	1.43 **	0.80 **	0.63 **	0.61 **
385	Measuring, photogr.,optical etc.	0.86 **	0.81 **	0.05	0.07	0.89 **	0.78 **	0.11 **	0.09 **
390	Other manufacturing industries	1.04 **	0.86 **	0.18 **	0.20 **	0.96 **	0.80 **	0.16 **	0.14 **

Note: ** indicates significance at 99 % level, * indicates significance at 95 % level.

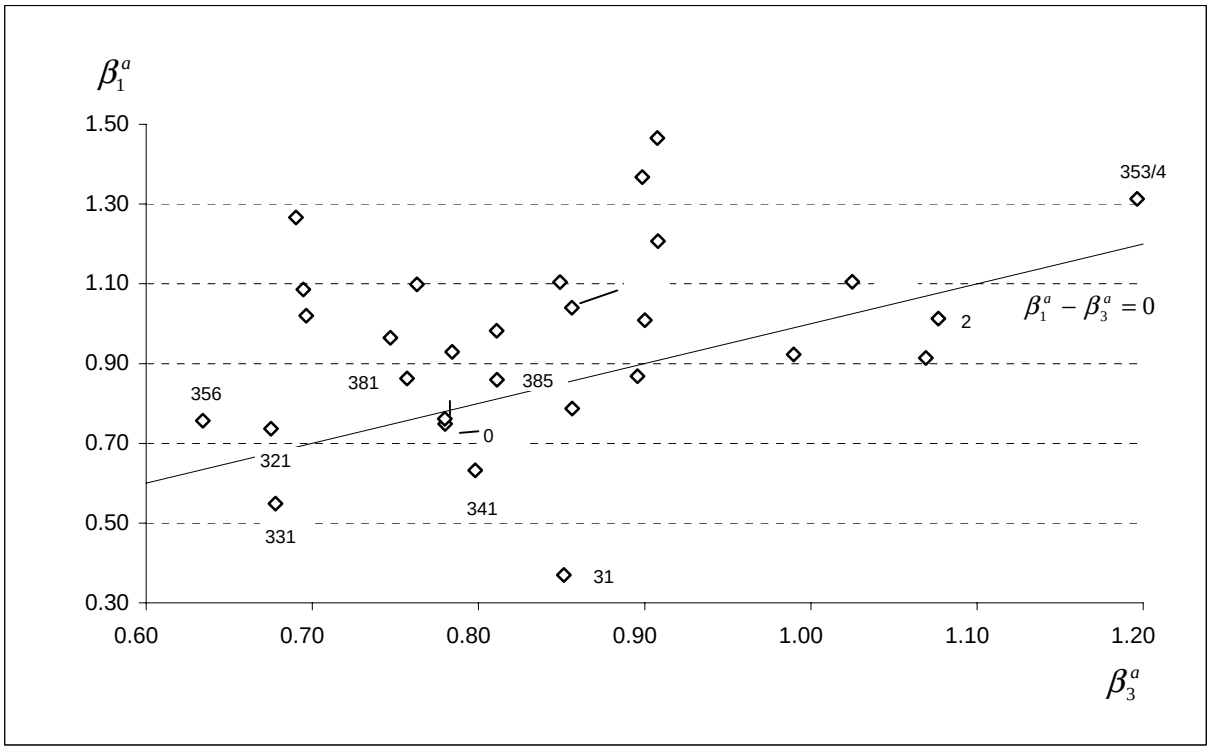
1) $\beta^a_1 - \beta^a_3$ of industry a minus $\beta^0_1 - \beta^0_3$ for total manufacturing.

Source: Own calculations, for method see text.

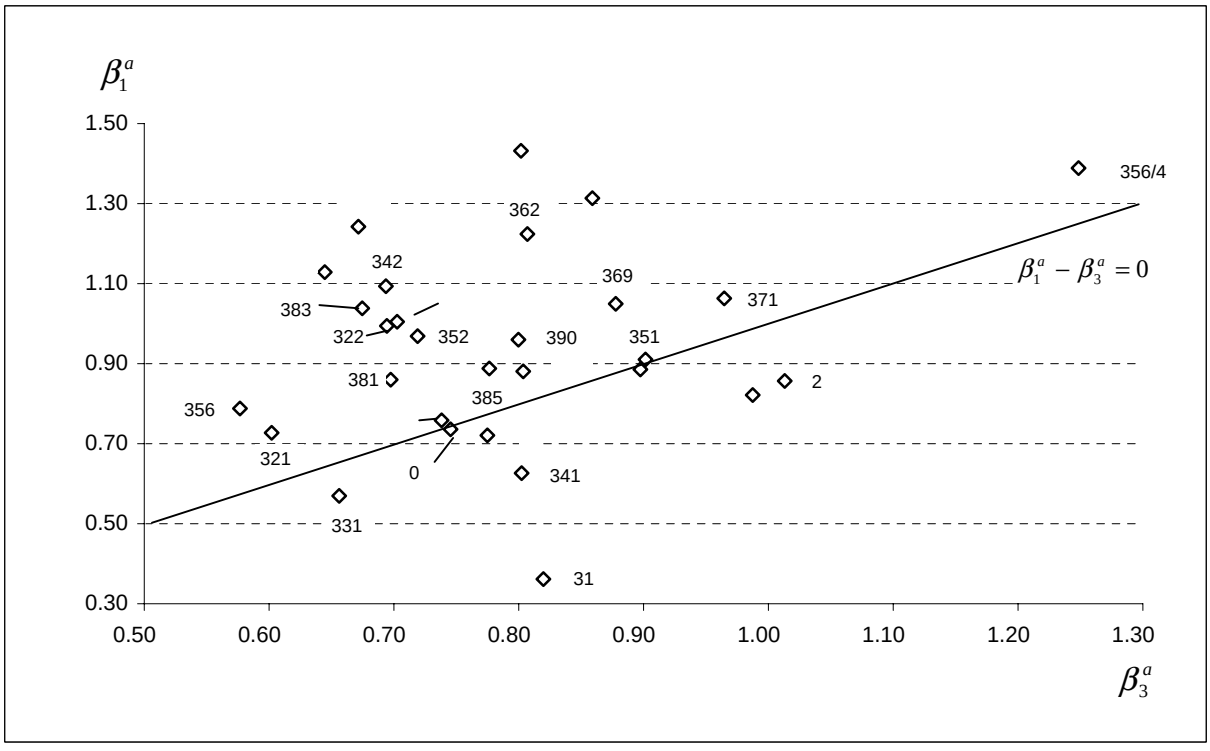
Figure 1

Sectoral income elasticities for trade among OECD countries

- Export statistics -



- Import statistics -



Source: Table 1.

Table 2

Per-capita-income elasticities: Results for three-digit industries for trade among 22 OECD countries 1988-90

		Export statistics						Import statistics					
		Shipments						Shipments					
	Product groups	Per capita income of the exporting country i		Per capita income of the importing country j		Export/ import ratio	RCA value	Per capita income of the exporting country i		Per capita income of the importing country j		Export/ import ratio	RCA value
	(ISIC Rev.2)	$ß^a_2$		$ß^a_4$		$ß^a_2 - ß^a_4$	1)	$ß^a_2$		$ß^a_4$		$ß^a_2 - ß^a_4$	1)
0	All products	0.29	**	-0.02		0.31 **	.	0.27	**	0.02		0.26 **	.
1	Agriculture	-0.74	**	-0.08		-0.66 **	.	-0.71	**	-0.02		-0.69 **	.
2	Mining and quarrying	-0.71	**	0.01		-0.73 **	.	-0.53	**	-0.32		-0.21	.
3	Manufacturing	0.34	**	-0.01		0.35 **	0.00	0.32	**	0.03		0.30 **	0.00
31	Food, beverages, tobacco	0.18		0.13		0.05	-0.30 **	0.24	**	0.07		0.17 *	-0.13
321	Textiles	-0.60	**	0.03		-0.63 **	-0.98 **	-0.62	**	0.16		-0.78 **	-1.07 **
322	Wearing apparel	-1.36	**	0.69	**	-2.06 **	-2.40 **	-1.38	**	1.21	**	-2.59 **	-2.89 **
323	Leather and leather products	-0.19		-0.22		0.03	-0.32 **	-0.12		-0.10		-0.02	-0.32 **
324	Footwear	-0.53	**	0.83	**	-1.37 **	-1.71 **	-0.63	**	0.89	**	-1.52 **	-1.82 **
331	Wood and wood products	1.02	**	0.36	*	0.66 **	0.31 *	1.09	**	0.39	**	0.69 **	0.40 **
332	Furniture	0.86	**	0.64	**	0.22	-0.13	0.68	**	0.98	**	-0.30 *	-0.60 **
341	Paper and paper products	1.85	**	-0.11		1.96 **	1.61 **	1.82	**	-0.20		2.02 **	1.72 **
342	Printing and publishing	0.99	**	0.47	**	0.52 **	0.17	0.77	**	0.67	**	0.10	-0.20 *
351	Industrial chemicals	0.33	**	-0.16		0.49 **	0.15	0.56	**	-0.31	**	0.86 **	0.57 **
352	Other chemical products	1.01	**	-0.03		1.04 **	0.69 **	0.90	**	0.00		0.90 **	0.60 **
353/4	Petroleum refineries and prod.	-0.56	**	-0.11		-0.45 **	-0.80 **	-0.57	**	-0.20		-0.37 *	-0.66 **
355	Rubber products	-0.17		0.26	*	-0.43 **	-0.77 **	-0.12		0.23	*	-0.35 **	-0.65 **
356	Plastic products	1.06	**	0.37	**	0.69 **	0.35 **	0.89	**	0.47	**	0.42 **	0.12
361	Pottery, china and earthware	-0.72	**	0.33	*	-1.06 **	-1.40 **	-0.65	**	0.35	**	-1.01 **	-1.30 **
362	Glass and glass products	-0.51	**	0.21		-0.72 **	-1.07 **	-0.52	**	0.26	*	-0.78 **	-1.08 **
369	Structural clay products	-0.57	**	0.00		-0.58 **	-0.92 **	-0.51	**	-0.04		-0.47 **	-0.76 **
371	Iron and steel basic industr.	0.12		-0.34	*	0.46 **	0.11	0.13		-0.29	*	0.42 **	0.13
372	Basic non ferrous metals	0.61	**	-0.09		0.70 **	0.35 **	0.79	**	-0.02		0.81 **	0.51 **
381	Fabricated metal products	0.47	**	0.06		0.41 **	0.07	0.44	**	0.20	*	0.24 **	-0.06
382	Machinery (excl. electrical)	1.17	**	-0.07		1.24 **	0.89 **	1.11	**	-0.03		1.14 **	0.85 **
383	Electrical machinery	0.78	**	0.07		0.72 **	0.37 **	0.69	**	0.07		0.63 **	0.33 **
384	Transport equipment	0.88	**	-0.06		0.94 **	0.59 **	0.72	**	0.04		0.68 **	0.38 **
385	Measuring, photogr.,optical etc.	1.95	**	0.15		1.80 **	1.45 **	1.70	**	0.04		1.65 **	1.36 **
390	Other manufacturing industries	0.65		0.42		0.24 *	-0.11	0.70	**	0.60	**	0.10	-0.20 **

Note: ** indicates significance at 99 % level, * indicates significance at 95 % level.

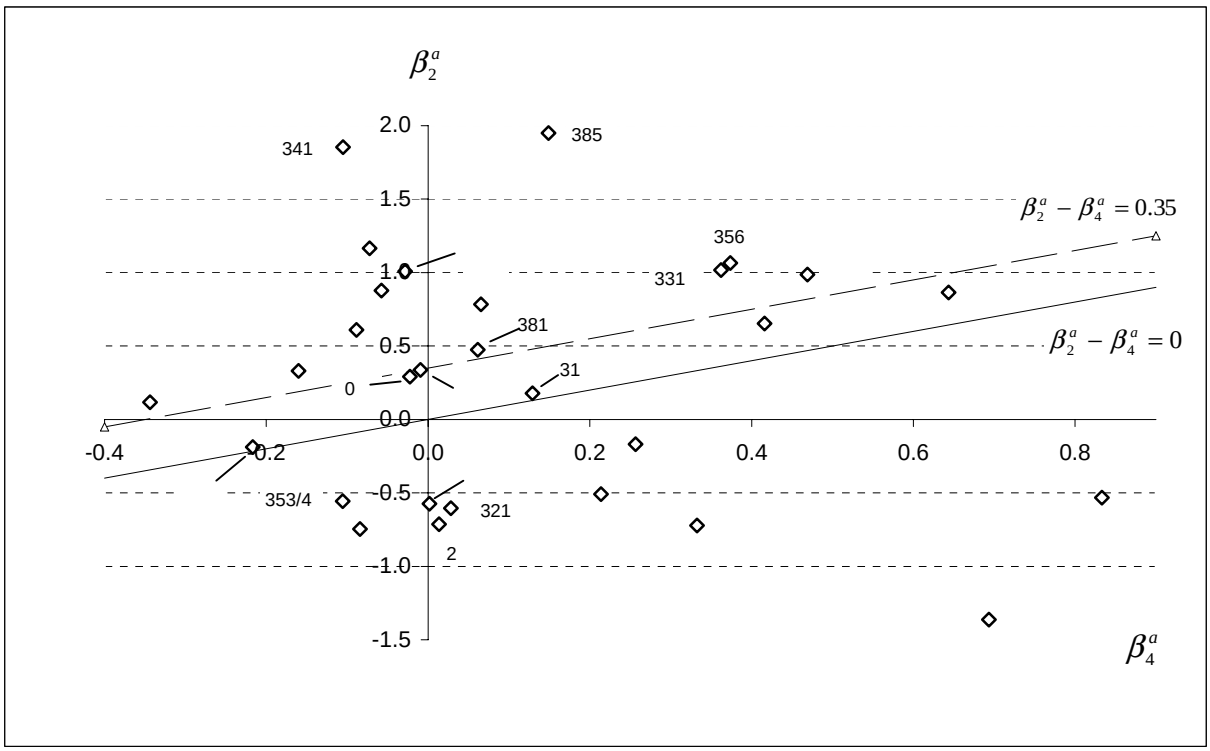
1) $ß^a_2 - ß^a_4$ of industry a minus $ß^0_2 - ß^0_4$ for total manufacturing.

Source: Own calculations, for method see text.

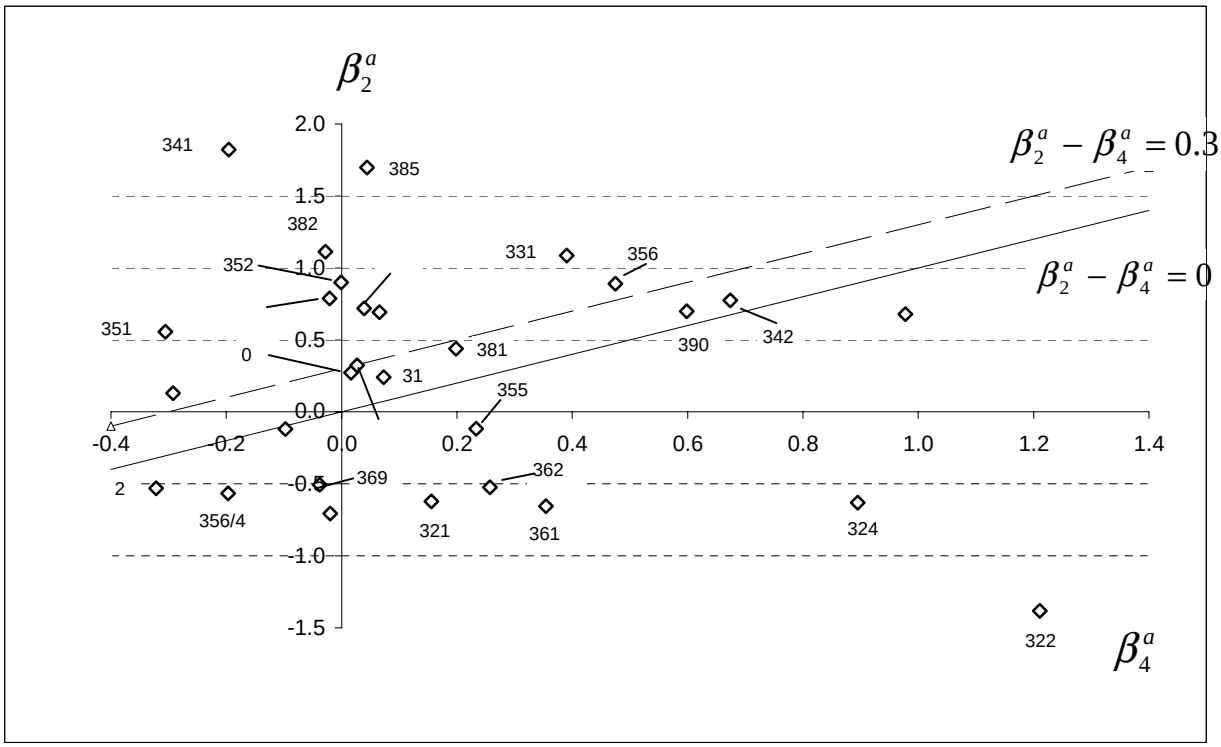
Figure 2

Sectoral per-capita-income elasticities for trade among OECD countries

- Export statistics -



- Import statistics -



Source: Table 2.

Table 3

Income elasticities: Results for three-digit industries for trade of 22 OECD countries with 70 countries 1988-90

	Product groups (ISIC Rev.2)	Per capita income of OECD country i				Per capita income of partner country j			
		OECD exports	OECD imports	Export/ import ratio	RCA value	OECD exports	OECD imports	Export/ import ratio	RCA value
		$ß^a_{1x}$	$ß^a_{1m}$	$ß^a_{1x} - ß^a_{1m}$	1)	$ß^a_{3x}$	$ß^a_{3m}$	$ß_{3x} - ß_{3m}$	2)
0	All products	0.87 **	1.03 **	-0.16 **		0.77 **	0.91 **	-0.14 **	
1	Agriculture	1.18 **	0.88 **	0.30 **		0.85 **	0.91 **	-0.06	
2	Mining and quarrying	1.12 **	1.36 **	-0.24 **		1.04 **	1.04 **	0.00	
3	Manufacturing	0.85 **	1.07 **	-0.21 **	0.00	0.75 **	1.04 **	-0.29 **	0.00
31	Food, beverages, tobacco	0.53 **	1.09 **	-0.57 **	-0.35 **	0.66 **	1.02 **	-0.36 **	-0.07
321	Textiles	1.17 **	0.83 **	0.34 **	0.55 **	0.71 **	1.35 **	-0.64 **	-0.35 **
322	Wearing apparel	1.18 **	0.79 **	0.39 **	0.61 **	0.60 **	1.06 **	-0.46 **	-0.17 **
323	Leather and leather products	1.04 **	0.90 **	0.13 **	0.35 **	0.81 **	1.36 **	-0.55 **	-0.26 **
324	Footwear	1.09 **	0.56 **	0.53 **	0.74 **	0.55 **	1.34 **	-0.80 **	-0.51 **
331	Wood and wood products	0.79 **	0.70 **	0.09	0.30 **	0.64 **	1.10 **	-0.46 **	-0.17 *
332	Furniture	1.01 **	0.75 **	0.26 **	0.47 **	0.56 **	1.04 **	-0.49 **	-0.20 **
341	Paper and paper products	0.80 **	0.73 **	0.07	0.28 **	0.71 **	1.26 **	-0.55 **	-0.26 **
342	Printing and publishing	1.19 **	0.62 **	0.56 **	0.78 **	0.64 **	1.02 **	-0.38 **	-0.09 *
351	Industrial chemicals	1.18 **	0.99 **	0.19 **	0.40 **	0.93 **	1.40 **	-0.48 **	-0.19 **
352	Other chemical products	0.96 **	0.87 **	0.09	0.30 **	0.73 **	1.31 **	-0.57 **	-0.28 **
353/4	Petroleum refineries and prod.	1.55 **	1.38 **	0.17 *	0.38 **	0.82 **	0.96 **	-0.14 *	0.15 *
355	Rubber products	1.51 **	0.53 **	0.98 **	1.19 **	0.59 **	1.27 **	-0.68 **	-0.39 **
356	Plastic products	1.02 **	0.57 **	0.44 **	0.66 **	0.58 **	1.00 **	-0.41 **	-0.12 **
361	Pottery, china and earthware	1.30 **	0.64 **	0.66 **	0.87 **	0.59 **	1.09 **	-0.50 **	-0.21 **
362	Glass and glass products	1.31 **	0.63 **	0.68 **	0.89 **	0.66 **	1.27 **	-0.61 **	-0.32 **
369	Structural clay products	1.28 **	0.77 **	0.51 **	0.72 **	0.74 **	1.19 **	-0.45 **	-0.16 **
371	Iron and steel basic industr.	1.53 **	0.97 **	0.56 **	0.77 **	0.97 **	1.48 **	-0.51 **	-0.22 **
372	Basic non ferrous metals	1.05 **	1.15 **	-0.10	0.11	0.97 **	1.10 **	-0.13	0.16 *
381	Fabricated metal products	1.10 **	0.80 **	0.30 **	0.51 **	0.69 **	1.33 **	-0.65 **	-0.36 **
382	Machinery (excl. electrical)	1.08 **	0.84 **	0.24 **	0.45 **	0.79 **	1.32 **	-0.52 **	-0.23 **
383	Electrical machinery	1.19 **	0.76 **	0.43 **	0.64 **	0.78 **	1.28 **	-0.51 **	-0.22 **
384	Transport equipment	1.61 **	0.80 **	0.81 **	1.02 **	0.78 **	1.42 **	-0.64 **	-0.35 **
385	Measuring, photogr.,optical etc.	1.07 **	0.78 **	0.29 **	0.50 **	0.83 **	1.14 **	-0.30 **	-0.01 **
390	Other manufacturing industries	1.21 **	0.88 **	0.33 **	0.54 **	0.67 **	1.21 **	-0.54 **	-0.25 **

Note: ** indicates significance at 99 % level, * indicates significance at 95 % level.

1) $ß^a_{1x} - ß^a_{1m}$ of industry a minus $ß^0_{1x} - ß^0_{1m}$ for total manufacturing.

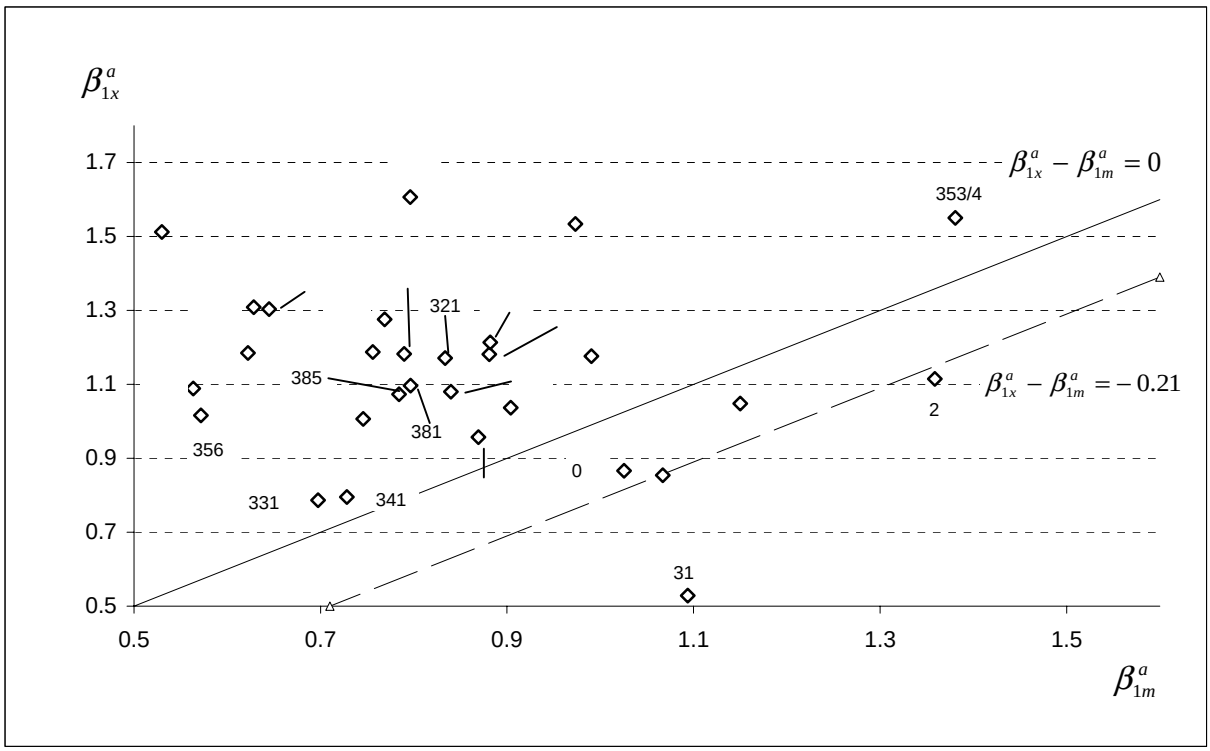
2) $ß^a_{3x} - ß^a_{3m}$ of industry a minus $ß^0_{3x} - ß^0_{3m}$ for total manufacturing.

Source: Own calculations, for method see text.

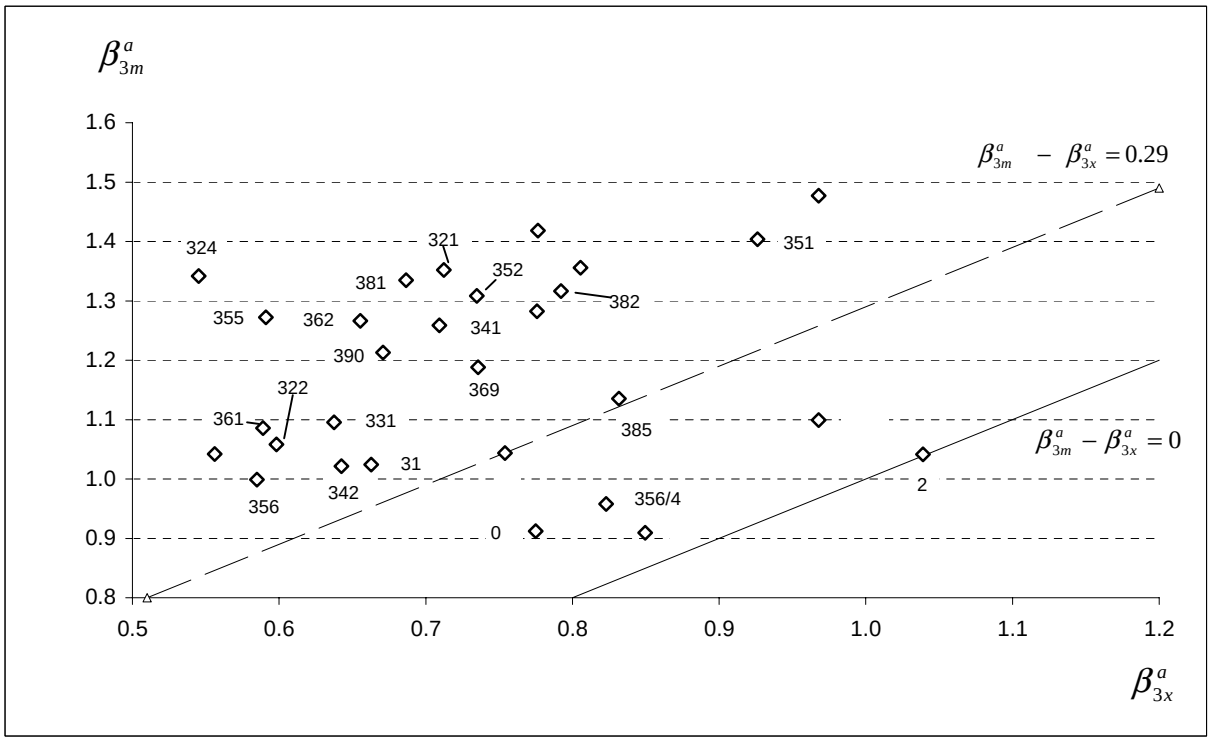
Figure 3

Sectoral income elasticities for trade of OECD countries with 70 countries

- Income of OECD country i -



- Income of partner country j -



Source: Table 3.

Table 4

Per-capita-income elasticities: Results for three-digit industries for trade of 22 OECD countries with 70 countries 1988-90

	Product groups	Per capita income of OECD country i				Per capita income of partner country j			
		OECD exports	OECD imports	Export/ import ratio	RCA value	OECD exports	OECD imports	Export/ import ratio	RCA value
	(ISIC Rev.2)	$ß^a_{2x}$	$ß^a_{2m}$	$ß^a_{2x} - ß^a_{2m}$	1)	$ß^a_{4x}$	$ß^a_{4m}$	$ß^a_{4x} - ß^a_{4m}$	2)
0	All products	0.40 **	-0.22 **	0.62 **	.	0.17 **	0.18 **	-0.02	.
1	Agriculture	-1.00 **	-0.16	-0.85 **	.	0.37 **	-0.53 **	0.90 **	.
2	Mining and quarrying	-0.46 **	-0.83 **	0.37 *	.	0.19 **	-0.15	0.34 **	.
3	Manufacturing	0.49 **	-0.21 **	0.70 **	0.00	0.17 **	0.28 **	-0.11 **	0.00
31	Food, beverages, tobacco	0.28 **	-0.28 **	0.57 **	-0.13	0.32 **	0.05	0.27 **	0.38 **
321	Textiles	-0.43 **	0.10	-0.52 **	-1.22 **	0.49 **	-0.01	0.50 **	0.61 **
322	Wearing apparel	-0.78 **	1.15 **	-1.92 **	-2.62 **	0.89 **	-0.09	0.98 **	1.09 **
323	Leather and leather products	-0.25 **	-0.19	-0.06	-0.76 **	0.58 **	-0.21 **	0.80 **	0.91 **
324	Footwear	-0.51 **	0.58 **	-1.10 **	-1.80 **	0.61 **	-0.24 **	0.85 **	0.96 **
331	Wood and wood products	0.33 **	0.22	0.11	-0.58 **	0.56 **	-0.04	0.60 **	0.71 **
332	Furniture	0.48 **	0.54 **	-0.06	-0.76 **	0.64 **	0.13 *	0.51 **	0.62 **
341	Paper and paper products	1.56 **	-0.32 **	1.88 **	1.18 **	0.15 **	0.76 **	-0.61 **	-0.50 **
342	Printing and publishing	0.71 **	0.39 **	0.32 **	-0.37 **	0.33 **	0.63 **	-0.30 **	-0.19 **
351	Industrial chemicals	0.36 **	-0.57 **	0.93 **	0.23 *	-0.06	0.63 **	-0.69 **	-0.58 **
352	Other chemical products	1.03 **	-0.05	1.09 **	0.39 **	0.11	0.69 **	-0.58 **	-0.47 **
353/4	Petroleum refineries and prod.	-0.74 **	-0.49 **	-0.25	-0.94 **	-0.02	0.46 **	-0.49 **	-0.37 **
355	Rubber products	-0.16 *	0.12	-0.28 *	-0.98 **	0.29 **	0.47 **	-0.19 **	-0.07
356	Plastic products	0.63 **	0.21 *	0.42 **	-0.27 **	0.45 **	0.78 **	-0.33 **	-0.22 **
361	Pottery, china and earthware	-0.51 **	0.33 **	-0.83 **	-1.53 **	0.46 **	0.11 *	0.36 **	0.47 **
362	Glass and glass products	-0.48 **	0.08	-0.56 **	-1.26 **	0.37 **	0.38 **	-0.01	0.10
369	Structural clay products	-0.48 **	0.02	-0.50 **	-1.19 **	0.18 **	0.35 **	-0.16 *	-0.05
371	Iron and steel basic industr.	-0.01	-0.33 **	0.32 *	-0.38 *	-0.08	0.31 **	-0.40 **	-0.28 **
372	Basic non ferrous metals	0.55 **	-0.38 **	0.93 **	0.23	0.20 **	0.46 **	-0.26 **	-0.15
381	Fabricated metal products	0.64 **	0.08	0.56 **	-0.14	0.22 **	0.53 **	-0.31 **	-0.20 **
382	Machinery (excl. electrical)	1.24 **	-0.13	1.36 **	0.67 **	0.10 **	0.97 **	-0.87 **	-0.76 **
383	Electrical machinery	1.03 **	0.17	0.86 **	0.17	0.22 **	0.82 **	-0.60 **	-0.48 **
384	Transport equipment	0.92 **	0.06	0.86 **	0.16	0.20 **	0.76 **	-0.56 **	-0.44 **
385	Measuring, photogr.,optical etc.	1.75 **	0.02	1.73 **	1.04 **	0.26 **	0.90 **	-0.65 **	-0.53 **
390	Other manufacturing industries	0.50 **	0.55 **	-0.05	-0.75 **	0.66 **	0.33 **	0.32 **	0.44 **

Note: ** indicates significance at 99 % level, * indicates significance at 95 % level.

1) $ß^a_{2x} - ß^a_{2m}$ of industry a minus $ß^0_{2x} - ß^0_{2m}$ for total manufacturing.

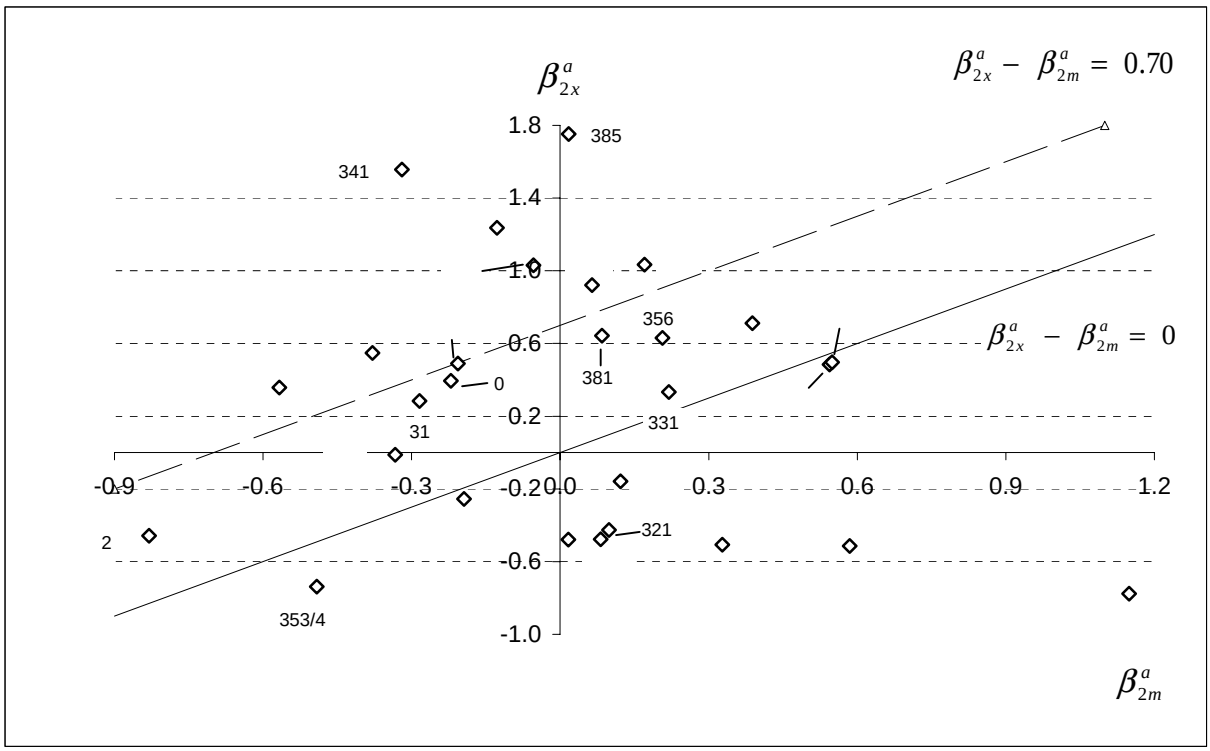
2) $ß^a_{4x} - ß^a_{4m}$ of industry a minus $ß^0_{4x} - ß^0_{4m}$ for total manufacturing.

Source: Own calculations, for method see text.

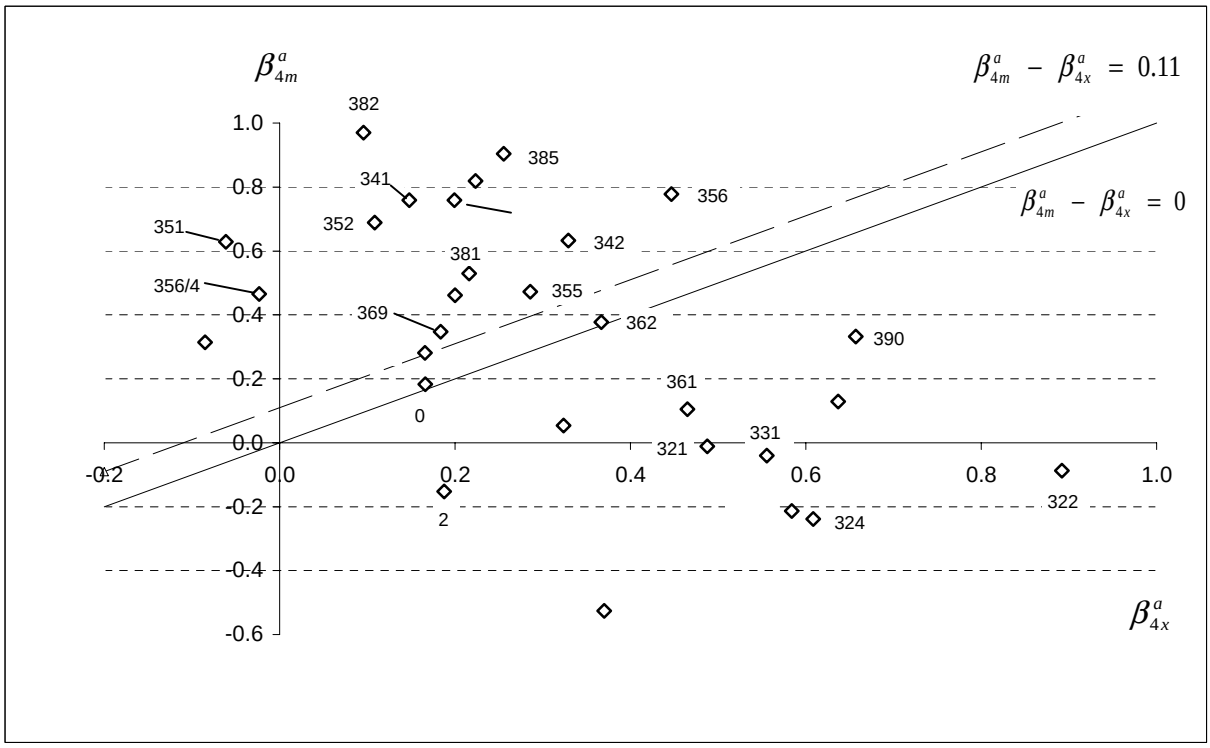
Figure 4

Sectoral per-capita-income elasticities for trade of OECD countries with 70 countries

- Per capita income of OECD country i -



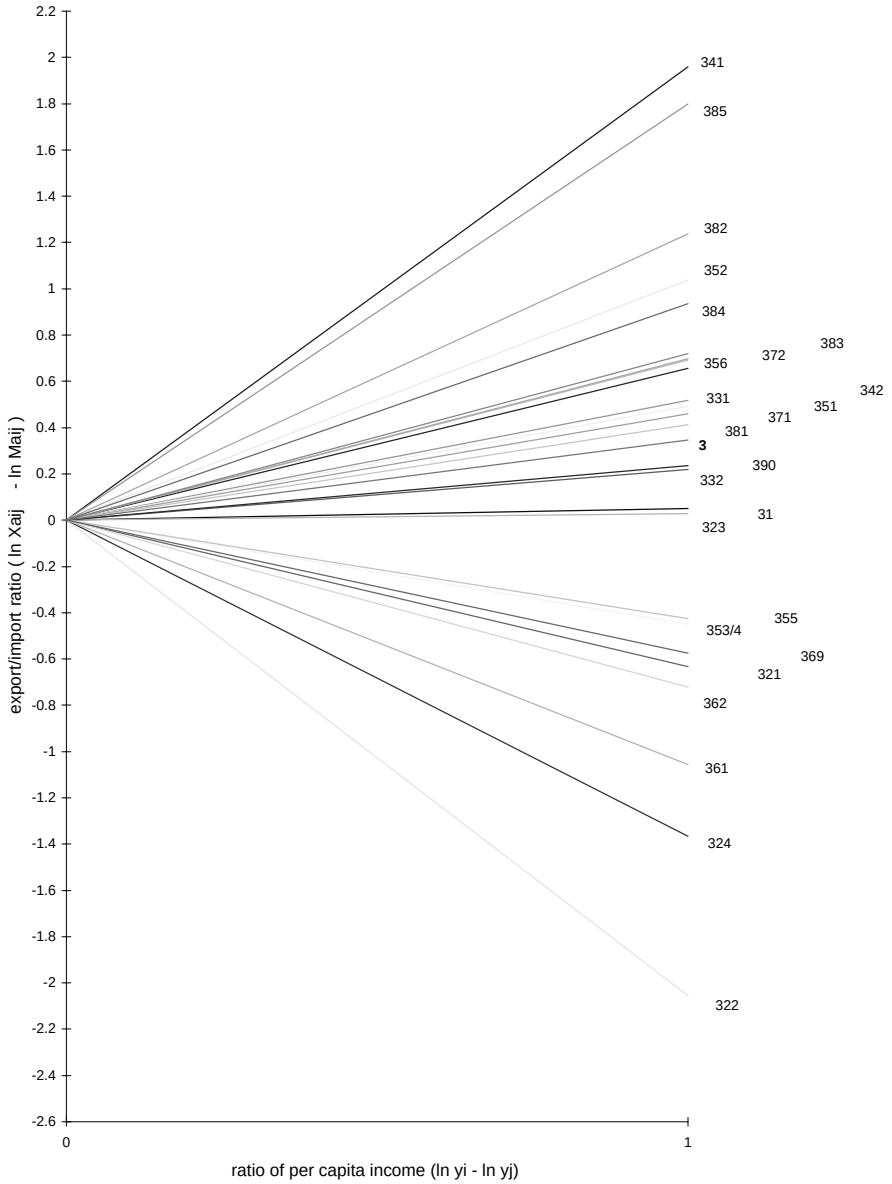
- Per capita income of partner country j -



Source: Table 4.

Figure 5

Sectoral export/import ratios as a function of relative per capita income in manufacturing trade among OECD countries: export statistics

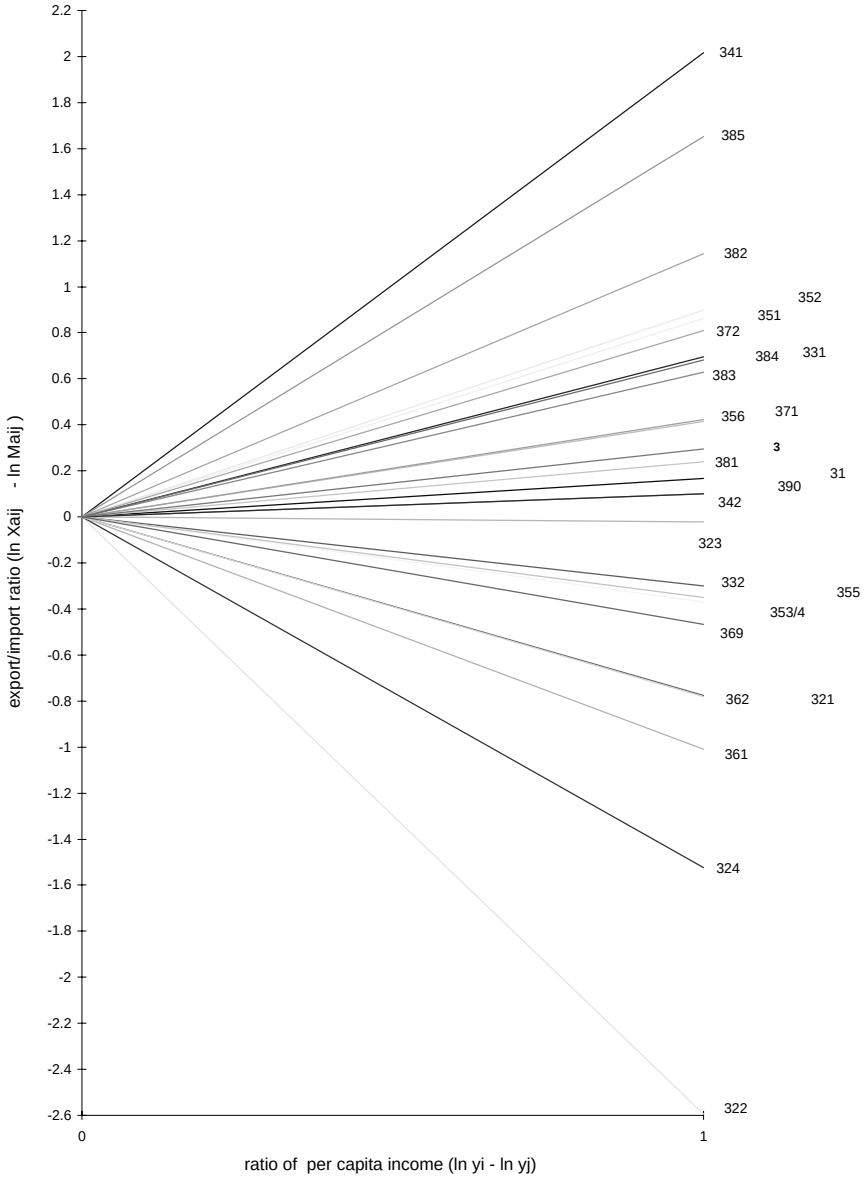


Note: For definition of sector numbers see Table 4.

Source: Own calculations.

Figure 6

Sectoral export/import ratios as a function of relative per capita income in manufacturing trade among OECD countries: import statistics

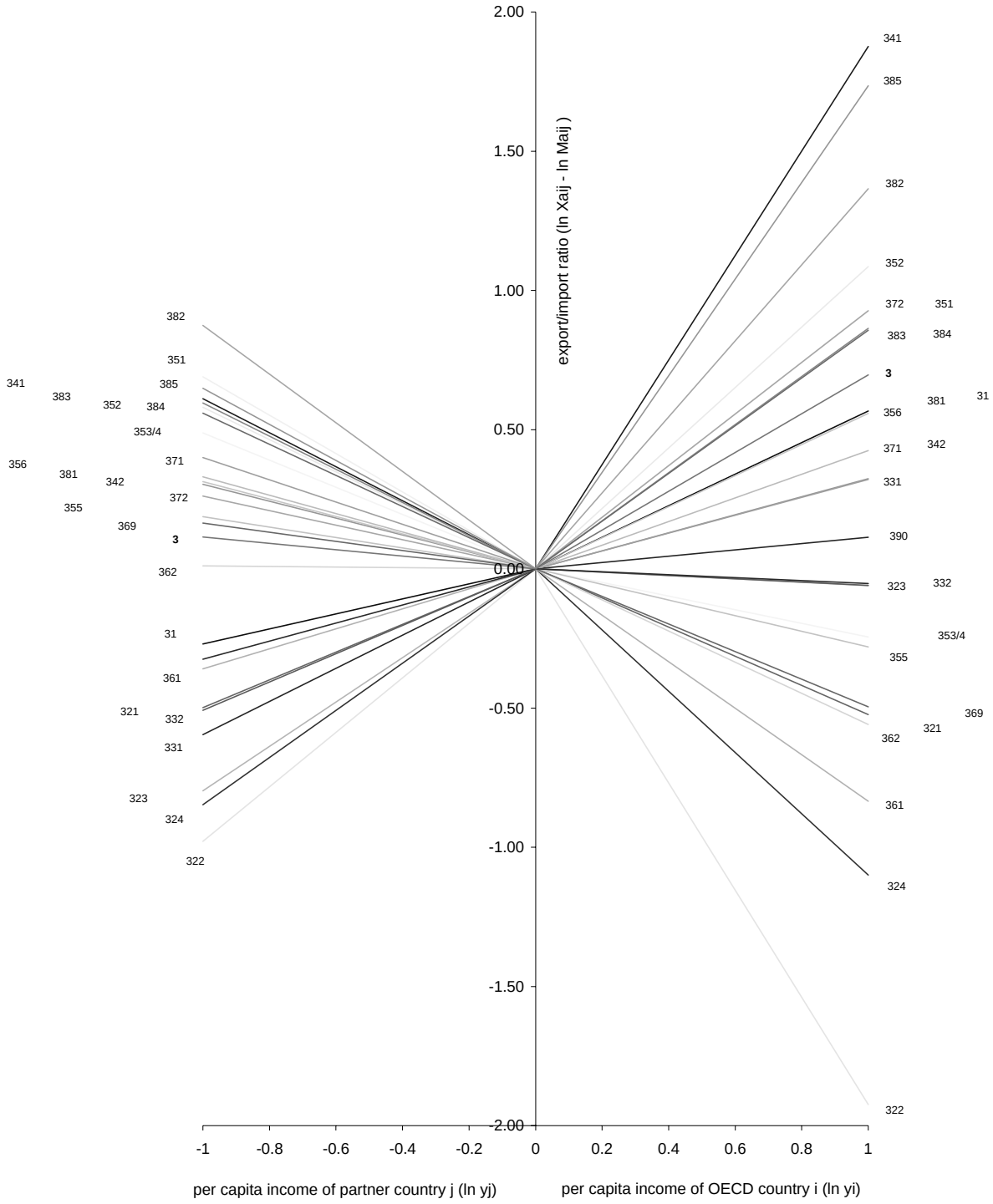


Note: For definition of sector numbers see Table 4.

Source: Own calculations.

Figure 7

Sectoral export/import ratios as a function of relative per capita income
in manufacturing trade of OECD coutries with 70 countries



Note: For definition of sector numbers see Table 4.
Source: Own calculations.

Appendix:

Supplementary Tables

Table A.1

Regression results for trade among 22 OECD countries by product groups: export statistics, 1988-90

Product groups	Y_i	y_i	Y_j	y_j	D_{ij}	ADJ_{ij}	EU_{ij}	$EFTA_{ij}$	$CUSTA_{ij}$	$APEC_{ij}$	LAN_{ij}	Col_{ij}	constant	standard error	adjusted R^2
All products	0.75 **	0.29 **	0.78 **	-0.02	-0.76 **	0.26 *	0.43 **	-0.16	-0.03	0.76 **	0.51 **	0.93 **	-9.36	0.62	0.89
	(29.8)	(5.8)	(31.2)	(-0.4)	(-23.3)	(2.1)	(5.2)	(-1.0)	(-0.1)	(4.6)	(4.2)	(2.6)			
1 Agriculture	0.79 **	-0.74 **	0.86 **	-0.08	-0.67 **	0.65 *	1.20 **	-0.50	-0.64	0.92 *	1.32 **	-0.80	-5.43	1.65	0.57
	(11.8)	(-5.6)	(12.9)	(-0.6)	(-7.7)	(2.0)	(5.4)	(-1.2)	(-0.5)	(2.1)	(4.1)	(-0.8)			
2 Mining and quarrying	1.01 **	-0.71 **	1.08 **	0.01	-1.46 **	-0.12	-0.14	-0.82	0.55	0.88	1.37 **	1.66	-7.12	2.40	0.51
	(10.5)	(-3.7)	(11.2)	(0.1)	(-11.6)	(-0.3)	(-0.4)	(-1.3)	(0.3)	(1.4)	(2.9)	(1.2)			
3 Manufacturing	0.76 **	0.34 **	0.78 **	-0.01	-0.83 **	0.19	0.46 **	-0.12	0.00	0.71 **	0.51 **	1.00 *	-9.75	0.70	0.88
	(27.1)	(6.0)	(27.8)	(-0.2)	(-22.6)	(1.4)	(4.9)	(-0.7)	(0.0)	(3.8)	(3.7)	(2.5)			
31 Food, beverages, tobacco	0.37 **	0.18	0.85 **	0.13	-0.48 **	0.55 *	1.81 **	-0.27	-0.64	1.00 **	1.14 **	0.78	-11.54	1.18	0.70
	(7.8)	(1.9)	(18.0)	(1.4)	(-7.7)	(2.3)	(11.5)	(-0.9)	(-0.7)	(3.2)	(4.9)	(1.1)			
321 Textiles	0.74 **	-0.60 **	0.68 **	0.03	-0.89 **	0.39	0.91 **	-0.06	-1.14	0.78 *	0.81 **	1.05	-2.65	1.25	0.67
	(14.6)	(-6.0)	(13.4)	(0.3)	(-13.4)	(1.6)	(5.4)	(-0.2)	(-1.2)	(2.3)	(3.3)	(1.4)			
322 Wearing apparel	0.98 **	-1.36 **	0.81 **	0.69 **	-1.64 **	-0.29	0.39 *	0.44	-1.19	0.47	0.70 *	1.40	-2.21	1.38	0.78
	(17.6)	(-12.2)	(14.6)	(6.2)	(-22.5)	(-1.0)	(2.1)	(1.3)	(-1.1)	(1.3)	(2.6)	(1.8)			
323 Leather and leather products	0.92 **	-0.19	0.99 **	-0.22	-1.04 **	0.15	0.62 **	0.22	-1.10	0.54	0.62 *	1.93 *	-11.88	1.48	0.67
	(15.5)	(-1.6)	(16.7)	(-1.8)	(-13.3)	(0.5)	(3.1)	(0.6)	(-1.0)	(1.4)	(2.1)	(2.3)			
324 Footwear	1.09 **	-0.53 **	0.69 **	0.83 **	-1.32 **	0.03	1.43 **	0.84	-0.42	-0.18	1.03 **	1.82	-15.81	1.98	0.63
	(13.6)	(-3.3)	(8.8)	(5.2)	(-12.7)	(0.1)	(5.4)	(1.7)	(-0.3)	(-0.3)	(2.7)	(1.6)			
331 Wood and wood products	0.55 **	1.02 **	0.68 **	0.36 *	-1.34 **	0.28	0.31	0.04	0.75	1.17 *	1.07 **	1.54	-17.69	2.04	0.57
	(6.7)	(6.2)	(8.3)	(2.2)	(-12.4)	(0.7)	(1.1)	(0.1)	(0.5)	(2.1)	(2.7)	(1.3)			
332 Furniture	0.87 **	0.86 **	0.90 **	0.64 **	-1.39 **	0.50	0.60 **	0.14	-0.11	0.46	0.75 *	2.28	-25.86	1.62	0.75
	(13.3)	(6.6)	(13.8)	(5.0)	(-16.3)	(1.6)	(2.8)	(0.3)	(-0.1)	(1.1)	(2.4)	(2.4)			
341 Paper and paper products	0.63 **	1.85 **	0.80 **	-0.11	-1.35 **	0.06	0.22	-0.12	0.59	1.39 **	0.02	2.76 *	-22.23	1.89	0.66
	(8.3)	(12.2)	(10.5)	(-0.7)	(-13.6)	(0.2)	(0.9)	(-0.2)	(0.4)	(2.7)	(0.0)	(2.5)			
342 Printing and publishing	1.10 **	0.99 **	0.76 **	0.47 **	-1.14 **	0.00 *	0.99 **	-0.30	-0.38	0.26	1.97 **	2.45 **	-28.35	1.32	0.82
	(20.7)	(9.3)	(14.4)	(4.4)	(-16.5)	(-0.0)	(5.6)	(-0.9)	(-0.4)	(0.7)	(7.6)	(3.2)			
351 Industrial chemicals	1.01 **	0.33 **	0.90 **	-0.16	-1.24 **	-0.11	0.45 *	-0.25	-0.37	0.64	0.61 *	1.61	-12.74	1.30	0.76
	(19.2)	(3.2)	(17.2)	(-1.5)	(-18.1)	(-0.4)	(2.6)	(-0.8)	(-0.4)	(1.8)	(2.4)	(2.1)			
352 Other chemical products	0.93 **	1.01 **	0.78 **	-0.03	-1.03 **	-0.16	0.86 **	-0.33	-0.66	-0.05	1.16 **	1.68 *	-20.46	1.40	0.74
	(16.4)	(8.9)	(13.9)	(-0.3)	(-13.9)	(-0.6)	(4.6)	(-0.9)	(-0.6)	(-0.1)	(4.2)	(2.1)			
353/4 Petroleum refineries and prod.	1.31 **	-0.56 **	1.20 **	-0.11	-1.76 **	-0.01	1.07 **	-0.08	-0.26	1.02	1.14 *	2.26	-11.62	2.45	0.62
	(13.3)	(-2.8)	(12.2)	(-0.5)	(-13.7)	(-0.0)	(3.3)	(-0.1)	(-0.1)	(1.6)	(2.4)	(1.6)			
355 Rubber products	1.27 **	-0.17	0.69 **	0.26 *	-1.27 **	-0.11	0.67 **	0.41	0.32	0.60	0.61 *	1.32	-14.72	1.39	0.76
	(22.6)	(-1.5)	(12.4)	(2.3)	(-17.4)	(-0.4)	(3.6)	(1.1)	(0.3)	(1.6)	(2.2)	(1.6)			
356 Plastic products	0.76 **	1.06 **	0.63 **	0.37 **	-1.15 **	0.28	0.96 **	-0.21	-0.12	0.57	1.07 **	1.37 *	-21.63	1.15	0.82
	(16.4)	(11.5)	(13.8)	(4.1)	(-19.1)	(1.2)	(6.3)	(-0.7)	(-0.1)	(1.8)	(4.8)	(2.1)			

Table A.1 continued

Regression results for trade among 22 OECD countries by product groups: export statistics, 1988-90

Product groups	Y_i	y_i	Y_j	y_j	D_{ij}	ADJ_{ij}	EU_{ij}	$EFTA_{ij}$	$CUSTA_{ij}$	$APEC_{ij}$	LAN_{ij}	Col_{ij}	constant	standard error	adjusted R^2
361 Pottery, china and earthenware	1.37 ** (19.6)	-0.72 ** (-5.2)	0.90 ** (12.9)	0.33 * (2.4)	-1.06 ** (-11.6)	0.30 (0.9)	0.80 ** (3.5)	0.75 (1.7)	-1.47 (-1.1)	-0.05 (-0.1)	0.83 * (2.4)	2.93 ** (2.9)	-17.46	1.73	0.68
362 Glass and glass products	1.21 ** (17.5)	-0.51 ** (-3.7)	0.91 ** (13.2)	0.21 (1.6)	-1.30 ** (-14.5)	0.14 (0.4)	0.37 (1.6)	0.25 (0.6)	-0.89 (-0.7)	0.80 * (1.7)	1.01 ** (3.0)	1.46 (1.5)	-13.31	1.71	0.68
369 Structural clay products	1.10 ** (17.6)	-0.57 ** (-4.6)	0.85 ** (13.6)	0.00 (0.0)	-1.31 ** (-16.1)	0.29 (0.9)	0.53 * (2.6)	0.36 (0.9)	0.06 (0.0)	0.39 (0.9)	0.44 (1.4)	1.94 * (2.2)	-8.17	1.55	0.70
371 Iron and steel basic industries	1.11 ** (14.3)	0.12 (0.8)	1.02 ** (13.4)	-0.34 * (-2.2)	-1.85 ** (-18.4)	-0.24 (-0.6)	-0.20 (-0.8)	0.70 (1.4)	-1.61 (-1.1)	2.07 ** (4.0)	0.01 (0.0)	2.97 ** (2.7)	-8.31	1.91	0.68
372 Basic non ferrous metals	0.91 ** (13.5)	0.61 ** (4.5)	1.07 ** (15.8)	-0.09 (-0.7)	-1.55 ** (-17.4)	-0.21 (-0.6)	-0.10 (-0.5)	0.49 (1.1)	-0.79 (-0.6)	1.87 ** (4.2)	0.35 (1.1)	1.78 (1.8)	-16.06	1.68	0.71
381 Fabricated metal products	0.86 ** (19.6)	0.47 ** (5.4)	0.76 ** (17.2)	0.06 (0.7)	-1.20 ** (-20.8)	0.16 (0.8)	0.42 ** (2.8)	0.27 (1.0)	-0.28 (-0.3)	0.59 * (2.0)	0.88 ** (4.1)	1.33 * (2.1)	-13.89	1.09	0.81
382 Machinery (excl. electrical)	0.96 ** (21.1)	1.17 ** (12.8)	0.75 ** (16.4)	-0.07 (-0.8)	-0.99 ** (-16.5)	-0.21 (-0.9)	0.43 ** (2.8)	-0.07 (-0.2)	0.21 (0.2)	-0.04 (-0.1)	0.86 ** (3.9)	1.09 (1.7)	-20.25	1.13	0.81
383 Electrical machinery	1.02 ** (20.5)	0.78 ** (7.9)	0.70 ** (14.1)	0.07 (0.7)	-1.06 ** (-16.3)	-0.30 (-1.2)	0.48 ** (2.9)	0.19 (0.6)	0.52 (0.5)	0.04 (0.1)	0.78 ** (3.2)	1.09 (1.5)	-18.08	1.23	0.77
384 Transport equipment	1.47 ** (24.8)	0.88 ** (7.4)	0.91 ** (15.4)	-0.06 (-0.5)	-1.24 ** (-16.1)	-0.16 * (-0.5)	0.53 ** (2.7)	0.06 (0.2)	0.49 (0.4)	0.80 * (2.0)	0.43 (1.5)	1.54 (1.8)	-24.68	1.47	0.80
385 Measuring, photogr.,optical etc.	0.86 ** (18.0)	1.95 ** (20.4)	0.81 ** (17.0)	0.15 (1.6)	-0.73 ** (-11.7)	0.03 (0.1)	0.70 ** (4.4)	-0.29 (-0.9)	-0.31 (-0.3)	0.00 (0.0)	0.78 ** (3.4)	1.41 * (2.1)	-33.12	1.19	0.83
390 Other manufacturing industries	1.04 ** (20.0)	0.65 ** (6.3)	0.86 ** (16.5)	0.42 ** (4.0)	-0.92 ** (-13.5)	0.26 (1.0)	0.50 ** (2.9)	-0.03 (-0.1)	-1.22 (-1.2)	0.26 (0.8)	0.59 * (2.3)	1.17 (1.6)	-25.39	1.29	0.77

Note: ** indicates significance at 99 % level, * indicates significance at 95 % level. 449 degrees of freedom.

Source: Own calculations, for method see text.

Table A.2

Regression results for trade among 22 OECD countries by product groups: import statistics, 1988-90

Product groups	Y_i	y_i	Y_j	y_j	D_{ij}	ADJ_{ij}	EU_{ij}	$EFTA_{ij}$	$CUSTA_{ij}$	$APEC_{ij}$	LAN_{ij}	Col_{ij}	constant	standard error	adjusted R^2
All products	0.74 **	0.27 **	0.75 **	0.02	-0.68 **	0.30 **	0.43 **	-0.18	0.01	0.73 **	0.51 **	0.66 *	-9.47	0.56	0.91
	(32.9)	(6.1)	(33.2)	(0.4)	(-23.3)	(2.7)	(5.8)	(-1.2)	(0.0)	(4.9)	(4.6)	(2.0)			
1 Agriculture	0.72 **	-0.71 **	0.77 **	-0.02	-0.58 **	0.82 *	1.12 **	-0.63	-0.24	1.44 **	0.47	2.08 *	-4.97	1.60	0.55
	(11.3)	(-5.5)	(12.1)	(-0.2)	(-6.9)	(2.6)	(5.3)	(-1.5)	(-0.2)	(3.4)	(1.5)	(2.3)			
2 Mining and quarrying	0.86 **	-0.53 **	1.01 **	-0.32	-1.25 **	-0.21	-0.25	-0.36	0.44	0.51	1.41 **	2.27	-3.50	2.10	0.50
	(10.2)	(-3.2)	(12.0)	(-1.9)	(-11.3)	(-0.5)	(-0.9)	(-0.7)	(0.3)	(0.9)	(3.4)	(1.9)			
3 Manufacturing	0.76 **	0.32 **	0.74 **	0.03	-0.74 **	0.21	0.47 **	-0.14	0.01	0.72 **	0.57 **	0.55	-9.96	0.62	0.89
	(30.4)	(6.4)	(29.4)	(0.5)	(-22.7)	(1.7)	(5.7)	(-0.9)	(0.0)	(4.3)	(4.6)	(1.5)			
31 Food, beverages, tobacco	0.36 **	0.24 **	0.82 **	0.07	-0.39 **	0.59 **	1.79 **	-0.23	-0.55	1.04 **	1.06 **	0.88	-11.60	1.05	0.73
	(8.6)	(2.9)	(19.4)	(0.9)	(-7.1)	(2.8)	(12.7)	(-0.9)	(-0.7)	(3.7)	(5.2)	(1.5)			
321 Textiles	0.73 **	-0.62 **	0.60 **	0.16	-0.79 **	0.46 *	0.90 **	-0.16	-0.98	0.78 *	0.75 **	0.56	-3.32	1.15	0.68
	(15.7)	(-6.7)	(12.9)	(1.7)	(-13.0)	(2.0)	(5.8)	(-0.5)	(-1.1)	(2.5)	(3.3)	(0.8)			
322 Wearing apparel	0.99 **	-1.38 **	0.69 **	1.21 **	-1.48 **	-0.41	0.69 **	0.27	-0.82	0.44	0.78 **	-0.17	-6.85	1.44	0.77
	(17.3)	(-12.0)	(12.0)	(10.5)	(-19.6)	(-1.4)	(3.6)	(0.7)	(-0.7)	(1.1)	(2.8)	(-0.2)			
323 Leather and leather products	0.89 **	-0.12	0.90 **	-0.10	-0.81 **	0.30	0.72 **	0.08	-0.92	0.32	0.62 *	0.10	-13.61	1.39	0.66
	(15.8)	(-1.1)	(16.0)	(-0.9)	(-11.1)	(1.1)	(3.9)	(0.2)	(-0.9)	(0.9)	(2.3)	(0.1)			
324 Footwear	1.13 **	-0.63 **	0.64 **	0.89 **	-1.14 **	-0.01	1.54 **	0.47	-0.32	-0.32	1.25 **	-0.83	-16.65	1.96	0.62
	(14.4)	(-4.0)	(8.2)	(5.7)	(-11.0)	(-0.0)	(5.9)	(0.9)	(-0.2)	(-0.6)	(3.3)	(-0.7)			
331 Wood and wood products	0.57 **	1.09 **	0.66 **	0.39 **	-1.23 **	0.30	0.27	0.05	0.67	1.23 *	1.04 **	1.76	-19.26	1.93	0.59
	(7.3)	(7.0)	(8.4)	(2.5)	(-12.1)	(0.8)	(1.0)	(0.1)	(0.5)	(2.4)	(2.7)	(1.6)			
332 Furniture	0.88 **	0.68 **	0.80 **	0.98 **	-1.33 **	0.51	0.61 **	0.05	-0.02	0.57 **	0.77 **	0.27	-26.65	1.50	0.77
	(14.6)	(5.6)	(13.3)	(8.1)	(-16.8)	(1.7)	(3.1)	(0.1)	(-0.0)	(1.4)	(2.6)	(0.3)			
341 Paper and paper products	0.63 **	1.82 **	0.80 **	-0.20	-1.33 **	0.00	0.16	-0.10	0.48	1.29 **	0.31	0.83	-21.11	1.80	0.67
	(8.7)	(12.6)	(11.1)	(-1.4)	(-14.0)	(-0.0)	(0.7)	(-0.2)	(0.3)	(2.7)	(0.9)	(0.8)			
342 Printing and publishing	1.09 **	0.77 **	0.69 **	0.67 **	-1.03 **	-0.02	0.94 **	-0.36	-0.39	-0.02	2.33 **	-0.08	-27.98	1.28	0.81
	(21.3)	(7.5)	(13.5)	(6.6)	(-15.3)	(-0.1)	(5.5)	(-1.1)	(-0.4)	(-0.1)	(9.3)	(-0.1)			
351 Industrial chemicals	0.91 **	0.56 **	0.90 **	-0.31 **	-1.10 **	-0.10	0.43 **	-0.27	-0.65	0.50 **	1.06 **	-0.53 *	-13.10	1.10	0.80
	(20.6)	(6.3)	(20.3)	(-3.4)	(-19.0)	(-0.5)	(2.9)	(-0.9)	(-0.8)	(1.7)	(4.9)	(-0.8)			
352 Other chemical products	0.97 **	0.90 **	0.72 **	0.00	-0.94 **	-0.16	0.79 **	-0.34	-0.61	-0.30	1.39 **	-0.43	-19.79	1.33	0.74
	(18.1)	(8.4)	(13.4)	(-0.0)	(-13.5)	(-0.6)	(4.4)	(-1.0)	(-0.6)	(-0.8)	(5.3)	(-0.6)			
353/4 Petroleum refineries and prod.	1.39 **	-0.57 **	1.25 **	-0.20	-1.63 **	-0.18	0.90 **	-0.26	-0.51	0.62	1.49 **	-0.96	-12.87	2.37	0.62
	(14.6)	(-3.0)	(13.0)	(-1.0)	(-13.0)	(-0.4)	(2.8)	(-0.4)	(-0.3)	(1.0)	(3.2)	(-0.7)			
355 Rubber products	1.24 **	-0.12	0.67 **	0.23 *	-1.14 **	-0.09	0.64 **	0.45	0.51	0.59	0.42	0.77	-15.19	1.26	0.77
	(24.6)	(-1.1)	(13.2)	(2.3)	(-17.1)	(-0.4)	(3.8)	(1.4)	(0.5)	(1.7)	(1.7)	(1.1)			
356 Plastic products	0.79 **	0.89 **	0.58 **	0.47 **	-1.07 **	0.18	0.96 **	-0.29	0.14	0.32	1.33 **	0.11	-21.05	1.11	0.81
	(17.6)	(9.9)	(12.9)	(5.3)	(-18.2)	(0.8)	(6.5)	(-1.0)	(0.2)	(1.1)	(6.1)	(0.2)			

Table A.2 continued

Regression results for trade among 22 OECD countries by product groups: import statistics, 1988-90

Product groups	Y_i	y_i	Y_j	y_j	D_{ij}	ADJ_{ij}	EU_{ij}	$EFTA_{ij}$	$CUSTA_{ij}$	$APEC_{ij}$	LAN_{ij}	Col_{ij}	constant	standard error	adjusted R^2
361 Pottery, china	1.31 **	-0.65 **	0.86 **	0.35 **	-0.90 **	0.35	0.87 **	0.67	-1.20	-0.68	1.32 **	-0.30	-18.18	1.62	0.68
and earthenware	(20.2)	(-5.0)	(13.2)	(2.7)	(-10.5)	(1.1)	(4.0)	(1.6)	(-1.0)	(-1.6)	(4.1)	(-0.3)			
362 Glass and glass	1.22 **	-0.52 **	0.81 **	0.26 *	-1.18 **	0.20	0.35	0.13	-0.71	0.54	1.19 **	0.09	-13.26	1.59	0.69
products	(19.1)	(-4.1)	(12.6)	(2.0)	(-14.1)	(0.6)	(1.7)	(0.3)	(-0.6)	(1.3)	(3.8)	(0.1)			
369 Structural clay	1.05 **	-0.51 **	0.88 **	-0.04	-1.25 **	0.28	0.46 *	0.45	0.06	0.17	0.56	-0.77	-8.41	1.49	0.70
products	(17.5)	(-4.2)	(14.6)	(-0.3)	(-15.8)	(0.9)	(2.3)	(1.2)	(0.1)	(0.4)	(1.9)	(-0.9)			
371 Iron and steel	1.06 **	0.13	0.96 **	-0.29 *	-1.71 **	-0.13	-0.12	0.63	-1.41	1.91 **	0.00	0.18	-8.52	1.74	0.69
basic industries	(15.2)	(0.9)	(13.8)	(-2.1)	(-18.7)	(-0.4)	(-0.5)	(1.4)	(-1.1)	(4.1)	(-0.0)	(0.2)			
372 Basic non	0.82 **	0.79 **	0.99 **	-0.02	-1.27 **	0.15	-0.02	0.34	-0.75	1.99 **	0.09	1.65	-18.14	1.52	0.72
ferrous metals	(13.4)	(6.4)	(16.1)	(-0.2)	(-15.8)	(0.5)	(-0.1)	(0.9)	(-0.6)	(4.9)	(0.3)	(1.9)			
381 Fabricated metal	0.86 **	0.44 **	0.70 **	0.20 *	-1.10 **	0.22	0.42 **	0.18	-0.21	0.54 *	0.96 **	0.17	-14.71	1.03	0.81
products	(20.7)	(5.3)	(16.7)	(2.4)	(-20.2)	(1.1)	(3.1)	(0.7)	(-0.3)	(2.0)	(4.7)	(0.3)			
382 Machinery	1.00 **	1.11 **	0.70 **	-0.03	-0.88 **	-0.27	0.51 **	-0.05	0.22	-0.13	1.09 **	0.06	-20.87	1.02	0.84
(excl. electrical)	(24.6)	(13.6)	(17.2)	(-0.3)	(-16.5)	(-1.3)	(3.8)	(-0.2)	(0.3)	(-0.5)	(5.5)	(0.1)			
383 Electrical	1.04 **	0.69 **	0.67 **	0.07	-0.98 **	-0.31	0.50 **	0.17	0.59	-0.06	0.93 **	0.21	-17.62	1.14	0.79
machinery	(22.6)	(7.5)	(14.6)	(0.7)	(-16.3)	(-1.4)	(3.2)	(0.6)	(0.7)	(-0.2)	(4.1)	(0.3)			
384 Transport	1.43 **	0.72 **	0.80 **	0.04	-1.08 **	-0.01	0.64 **	-0.02	0.63	0.79 *	0.56	1.28	-23.60	1.47	0.78
equipment	(24.3)	(6.1)	(13.6)	(0.3)	(-14.0)	(-0.0)	(3.2)	(-0.0)	(0.6)	(2.0)	(1.9)	(1.5)			
385 Measuring, pho-	0.89 **	1.70 **	0.78 **	0.04	-0.64 **	0.02	0.72 **	-0.21	-0.32	-0.14	1.06 **	0.12	-30.14	1.11	0.83
togr.,optical etc.	(19.9)	(19.0)	(17.3)	(0.5)	(-11.0)	(0.1)	(4.9)	(-0.7)	(-0.4)	(-0.5)	(4.9)	(0.2)			
390 Other manufac-	0.96 **	0.70 **	0.80 **	0.60 **	-0.80 **	0.05	0.63 **	-0.23	-0.83	0.10	0.74 **	-0.27	-26.54	1.22	0.78
turing industries	(19.7)	(7.2)	(16.3)	(6.1)	(-12.5)	(0.2)	(3.9)	(-0.7)	(-0.9)	(0.3)	(3.1)	(-0.4)			

Note: ** indicates significance at 99 % level, * indicates significance at 95 % level. 449 degrees of freedom.

Source: Own calculations, for method see text.

Table A.3

Regression results for exports of 22 OECD countries to 70 countries by product groups, 1988-90

Product groups	Y_i	y_i	Y_j	y_j	D_{ij}	ADJ_{ij}	EU_{ij}	$EFTA_{ij}$	$CUSTA_{ij}$	$APEC_{ij}$	LAN_{ij}	Col_{ij}	constant	standard error	adjusted R^2
All products	0.87 **	0.40 **	0.77 **	0.17 **	-0.89 **	0.04	0.33 **	-0.41	-0.71	1.05 **	0.70 **	1.31 **	-12.54	1.02	0.84
	(39.2)	(9.1)	(37.2)	(6.7)	(-23.7)	(0.2)	(2.7)	(-1.6)	(-0.9)	(7.6)	(6.4)	(5.8)			
1 Agriculture	1.18 **	-1.00 **	0.85 **	0.37 **	-0.99 **	-0.06	1.16 **	-0.58	-2.61	1.96 **	2.16 **	0.23	-9.87	2.34	0.61
	(23.2)	(-10.0)	(17.7)	(6.5)	(-11.5)	(-0.1)	(4.2)	(-1.0)	(-1.5)	(6.2)	(8.6)	(0.4)			
2 Mining and quarrying	1.12 **	-0.46 **	1.04 **	0.19 **	-1.42 **	-0.10	0.24	-0.70	-0.64	2.04 **	1.40 **	2.16 **	-12.61	2.40	0.62
	(21.3)	(-4.4)	(21.1)	(3.2)	(-16.1)	(-0.2)	(0.8)	(-1.2)	(-0.4)	(6.3)	(5.4)	(4.1)			
3 Manufacturing	0.85 **	0.49 **	0.75 **	0.17 **	-0.97 **	0.00	0.30 **	-0.44	-0.59	1.02 **	0.59 **	1.48 **	-12.58	1.09	0.83
	(36.1)	(10.5)	(33.8)	(6.3)	(-24.3)	(-0.0)	(2.4)	(-1.7)	(-0.7)	(6.9)	(5.1)	(6.2)			
31 Food, beverages, tobacco	0.53 **	0.28 **	0.66 **	0.32 **	-0.84 **	-0.01	1.36 **	-0.96 *	-1.41	1.45 **	1.60 **	1.54 **	-11.09	1.97	0.57
	(12.3)	(3.4)	(16.4)	(6.7)	(-11.6)	(-0.0)	(5.8)	(-2.0)	(-1.0)	(5.4)	(7.5)	(3.5)			
321 Textiles	1.17 **	-0.43 **	0.71 **	0.49 **	-1.21 **	-0.14	0.82 **	-0.21	-2.33	1.31 **	0.77 **	1.92 **	-12.19	1.93	0.69
	(27.8)	(-5.1)	(18.0)	(10.3)	(-17.0)	(-0.4)	(3.6)	(-0.5)	(-1.6)	(5.0)	(3.7)	(4.5)			
322 Wearing apparel	1.18 **	-0.78 **	0.60 **	0.89 **	-1.50 **	-0.25	1.00 **	0.48	-1.25	0.46	0.92 **	2.95 **	-10.97	1.80	0.77
	(30.2)	(-10.1)	(16.2)	(20.3)	(-22.6)	(-0.8)	(4.7)	(1.1)	(-0.9)	(1.9)	(4.7)	(7.4)			
323 Leather and leather products	1.04 **	-0.25 **	0.81 **	0.58 **	-0.95 **	0.17	1.19 **	0.23	-1.66	1.16 **	0.84 **	2.61 **	-19.03	1.85	0.72
	(25.8)	(-3.2)	(21.3)	(13.0)	(-14.0)	(0.5)	(5.4)	(0.5)	(-1.2)	(4.6)	(4.2)	(6.4)			
324 Footwear	1.09 **	-0.51 **	0.55 **	0.61 **	-1.29 **	0.11	1.52 **	1.00	0.03	-0.01	0.80 **	2.93 **	-12.30	1.99	0.68
	(25.2)	(-6.0)	(13.4)	(12.6)	(-17.7)	(0.3)	(6.4)	(2.1)	(0.0)	(-0.0)	(3.7)	(6.7)			
331 Wood and wood products	0.79 **	0.33 **	0.64 **	0.56 **	-1.69 **	0.02	0.00	0.16	0.56	1.31 **	1.09 **	1.87 **	-12.88	2.07	0.67
	(17.5)	(3.8)	(15.0)	(11.0)	(-22.1)	(0.0)	(0.0)	(0.3)	(0.4)	(4.7)	(4.9)	(4.1)			
332 Furniture	1.01 **	0.48 **	0.56 **	0.64 **	-1.38 **	0.64 *	0.52 *	0.19	0.54	0.27	0.68 **	2.24 **	-19.80	1.76	0.74
	(26.3)	(6.4)	(15.4)	(14.9)	(-21.2)	(2.0)	(2.5)	(0.4)	(0.4)	(1.1)	(3.6)	(5.8)			
341 Paper and paper products	0.80 **	1.56 **	0.71 **	0.15 **	-1.59 **	-0.03	-0.13	-0.36	-0.16	2.02 **	-0.12	2.43 **	-20.80	2.08	0.66
	(17.6)	(17.5)	(16.7)	(2.9)	(-20.8)	(-0.1)	(-0.5)	(-0.7)	(-0.1)	(7.2)	(-0.6)	(5.3)			
342 Printing and publishing	1.19 **	0.71 **	0.64 **	0.33 **	-1.18 **	-0.02	0.94 **	-0.15	-0.24	0.30	2.06 **	2.98 **	-23.73	1.54	0.79
	(35.4)	(10.8)	(20.3)	(8.8)	(-20.8)	(-0.1)	(5.1)	(-0.4)	(-0.2)	(1.4)	(12.5)	(8.7)			
351 Industrial chemicals	1.18 **	0.36 **	0.93 **	-0.06	-1.31 **	-0.11	0.18	-0.41	-1.11	1.06 **	0.24	1.83 **	-15.57	1.85	0.69
	(29.2)	(4.5)	(24.4)	(-1.4)	(-19.3)	(-0.3)	(0.8)	(-0.9)	(-0.8)	(4.2)	(1.2)	(4.5)			
352 Other chemical products	0.96 **	1.03 **	0.73 **	0.11	-1.27 **	-0.30	0.32	-0.91 *	-1.07	0.33	0.85 **	2.42 **	-19.55	1.79	0.69
	(24.7)	(13.5)	(20.1)	(2.5)	(-19.3)	(-0.9)	(1.5)	(-2.1)	(-0.8)	(1.4)	(4.4)	(6.1)			
353/4 Petroleum refineries and prod.	1.55 **	-0.74 **	0.82 **	-0.02	-1.76 **	0.18	0.96 **	-0.12	-0.22	1.50 **	0.67 **	2.56 **	-8.93	2.41	0.63
	(29.6)	(-7.2)	(16.7)	(-0.4)	(-19.9)	(0.4)	(3.3)	(-0.2)	(-0.1)	(4.6)	(2.6)	(4.8)			
355 Rubber products	1.51 **	-0.16 *	0.59 **	0.29 **	-1.38 **	-0.14	0.63 **	0.45	0.43	0.37	0.48 **	1.62 **	-16.17	1.69	0.75
	(41.2)	(-2.2)	(17.1)	(7.0)	(-22.2)	(-0.5)	(3.1)	(1.1)	(0.3)	(1.6)	(2.7)	(4.3)			
356 Plastic products	1.02 **	0.63 **	0.58 **	0.45 **	-1.28 **	0.20	0.76 **	-0.02	-0.52	0.92 **	0.82 **	2.13 **	-19.79	1.47	0.79
	(31.9)	(10.1)	(19.5)	(12.5)	(-23.7)	(0.8)	(4.3)	(-0.1)	(-0.5)	(4.6)	(5.2)	(6.6)			

Table A.3 continued

Regression results for exports of 22 OECD countries to 70 countries by product groups, 1988-90

Product groups	Y_i	y_i	Y_j	y_j	D_{ij}	ADJ_{ij}	EU_{ij}	$EFTA_{ij}$	$CUSTA_{ij}$	$APEC_{ij}$	LAN_{ij}	Col_{ij}	constant	standard error	adjusted R^2
361 Pottery, china and earthenware	1.30 ** (34.2)	-0.51 ** (-6.8)	0.59 ** (16.4)	0.46 ** (10.9)	-0.96 ** (-14.9)	0.65 * (2.1)	0.91 ** (4.3)	0.52 (1.2)	-1.16 (-0.9)	0.46 (1.9)	0.30 (1.6)	3.12 ** (8.1)	-16.88	1.75	0.71
362 Glass and glass products	1.31 ** (32.5)	-0.48 ** (-6.0)	0.66 ** (17.3)	0.37 ** (8.1)	-1.27 ** (-18.6)	0.36 (1.1)	0.21 (1.0)	-0.04 (-0.1)	-0.50 (-0.4)	0.68 ** (2.7)	0.56 ** (2.8)	2.03 ** (4.9)	-13.29	1.85	0.69
369 Structural clay products	1.28 ** (29.7)	-0.48 ** (-5.7)	0.74 ** (18.1)	0.18 ** (3.8)	-1.48 ** (-20.3)	-0.01 (-0.0)	0.25 (1.1)	0.12 (0.2)	0.22 (0.2)	0.51 (1.9)	-0.05 (-0.2)	2.58 ** (5.9)	-10.06	1.98	0.66
371 Iron and steel basic industries	1.53 ** (31.0)	-0.01 (-0.1)	0.97 ** (20.8)	-0.08 (-1.5)	-1.79 ** (-21.3)	-0.22 (-0.5)	-0.29 (-1.1)	0.75 (1.3)	-2.03 (-1.2)	1.63 ** (5.3)	-0.08 (-0.3)	2.47 ** (4.9)	-14.42	2.27	0.67
372 Basic non ferrous metals	1.05 ** (23.1)	0.55 ** (6.1)	0.97 ** (22.6)	0.20 ** (3.9)	-1.57 ** (-20.4)	-0.24 (-0.6)	-0.09 (-0.4)	0.30 (0.6)	-1.67 (-1.1)	2.36 ** (8.3)	0.64 ** (2.8)	2.22 ** (4.8)	-18.46	2.09	0.69
381 Fabricated metal products	1.10 ** (32.3)	0.64 ** (9.6)	0.69 ** (21.5)	0.22 ** (5.7)	-1.35 ** (-23.5)	-0.08 (-0.3)	0.17 (0.9)	-0.04 (-0.1)	-0.76 (-0.7)	0.72 ** (3.4)	0.80 ** (4.8)	1.97 ** (5.7)	-17.66	1.56	0.75
382 Machinery (excl. electrical)	1.08 ** (33.4)	1.24 ** (19.4)	0.79 ** (26.0)	0.10 ** (2.6)	-1.12 ** (-20.5)	-0.35 (-1.3)	0.22 (1.3)	-0.32 (-0.9)	-0.47 (-0.4)	0.25 (1.3)	0.80 ** (5.0)	1.63 ** (4.9)	-23.40	1.49	0.78
383 Electrical machinery	1.19 ** (33.3)	1.03 ** (14.7)	0.78 ** (23.1)	0.22 ** (5.6)	-1.15 ** (-19.1)	-0.43 (-1.4)	0.34 (1.8)	-0.04 (-0.1)	-0.63 (-0.5)	0.64 ** (2.9)	0.67 ** (3.8)	2.00 ** (5.5)	-24.21	1.64	0.76
384 Transport equipment	1.61 ** (39.7)	0.92 ** (11.6)	0.78 ** (20.3)	0.20 ** (4.4)	-1.34 ** (-19.6)	-0.28 (-0.8)	0.44 * (2.0)	-0.22 (-0.5)	0.38 (0.3)	0.72 ** (2.9)	0.52 ** (2.6)	1.95 ** (4.7)	-26.88	1.86	0.77
385 Measuring, photogr.,optical etc.	1.07 ** (32.4)	1.75 ** (26.9)	0.83 ** (26.6)	0.26 ** (6.9)	-0.90 ** (-16.0)	-0.15 (-0.5)	0.42 * (2.3)	-0.41 (-1.1)	-1.06 (-0.9)	0.21 (1.0)	0.88 ** (5.4)	2.18 ** (6.5)	-33.76	1.52	0.80
390 Other manufacturing industries	1.21 ** (31.3)	0.50 ** (6.5)	0.67 ** (18.3)	0.66 ** (15.1)	-1.06 ** (-16.1)	0.01 (0.0)	0.38 (1.8)	-0.24 (-0.6)	-1.67 (-1.3)	0.67 ** (2.8)	0.80 ** (4.2)	2.18 ** (5.5)	-24.96	1.78	0.75

Note: ** indicates significance at 99 % level, * indicates significance at 95 % level. 1505 degrees of freedom.

Source: Own calculations, for method see text.

Table A.4

Regression results for imports of 22 OECD countries from 70 countries by product groups, 1988-90

Product groups	Y_i	y_i	Y_j	y_j	D_{ij}	ADJ_{ij}	EU_{ij}	$EFTA_{ij}$	$CUSTA_{ij}$	$APEC_{ij}$	LAN_{ij}	Col_{ij}	constant	standard error	adjusted R^2
All products	1.03 **	-0.22 **	0.91 **	0.18 **	-0.75 **	0.06	0.36 *	0.22	-0.86	1.03 **	0.51 **	1.37 **	-11.48	1.54	0.72
	(30.6)	(-3.3)	(28.9)	(4.9)	(-13.2)	(0.2)	(2.0)	(0.6)	(-0.8)	(4.9)	(3.1)	(4.0)			
1 Agriculture	0.88 **	-0.16	0.91 **	-0.53 **	-0.34 **	1.21 **	1.91 **	0.33	-0.10	1.47 **	0.03	2.40 **	-11.41	2.51	0.39
	(16.1)	(-1.4)	(17.6)	(-8.6)	(-3.7)	(2.7)	(6.4)	(0.5)	(-0.1)	(4.3)	(0.1)	(4.3)			
2 Mining and quarrying	1.36 **	-0.83 **	1.04 **	-0.15	-1.45 **	-0.38	-1.03 **	-0.50	0.15	0.30	0.40	2.89 **	-6.72	3.28	0.41
	(19.1)	(-5.9)	(15.5)	(-1.9)	(-12.0)	(-0.7)	(-2.6)	(-0.6)	(0.1)	(0.7)	(1.1)	(4.0)			
3 Manufacturing	1.07 **	-0.21 **	1.04 **	0.28 **	-0.75 **	-0.14	0.70 **	0.58	-1.22	1.25 **	0.75 **	1.47 **	-15.06	1.73	0.73
	(28.4)	(-2.8)	(29.4)	(6.7)	(-11.8)	(-0.4)	(3.4)	(1.4)	(-1.0)	(5.3)	(4.0)	(3.9)			
31 Food, beverages, tobacco	1.09 **	-0.28 **	1.02 **	0.05	-0.32 **	0.62	2.58 **	1.44 *	-1.84	1.82 **	0.73 **	1.92 **	-19.36	2.51	0.54
	(20.1)	(-2.6)	(19.9)	(0.9)	(-3.4)	(1.4)	(8.7)	(2.4)	(-1.0)	(5.4)	(2.7)	(3.5)			
321 Textiles	0.83 **	0.10	1.35 **	-0.01	-0.54 **	0.40	1.95 **	0.94	-2.94	1.58 **	0.94 **	2.13 **	-21.76	2.62	0.56
	(14.6)	(0.9)	(25.2)	(-0.2)	(-5.6)	(0.8)	(6.3)	(1.5)	(-1.5)	(4.4)	(3.3)	(3.7)			
322 Wearing apparel	0.79 **	1.15 **	1.06 **	-0.09	-0.80 **	0.13	2.19 **	0.87	-2.82	1.78 **	1.18 **	1.76 **	-26.47	2.90	0.49
	(12.5)	(9.3)	(17.8)	(-1.2)	(-7.5)	(0.2)	(6.3)	(1.2)	(-1.3)	(4.5)	(3.8)	(2.8)			
323 Leather and leather products	0.90 **	-0.19	1.36 **	-0.21 **	-0.42 **	0.71	1.71 **	1.36 *	-2.06	1.12 **	0.56 *	1.31 *	-21.29	2.40	0.56
	(17.3)	(-1.9)	(27.5)	(-3.7)	(-4.8)	(1.6)	(6.0)	(2.3)	(-1.2)	(3.4)	(2.2)	(2.5)			
324 Footwear	0.56 **	0.58 **	1.34 **	-0.24 **	-0.54 **	0.84	2.39 **	1.32 *	-2.69	2.20 **	0.58 *	1.35 *	-23.92	2.49	0.56
	(10.4)	(5.5)	(26.3)	(-3.9)	(-5.8)	(1.9)	(8.1)	(2.2)	(-1.5)	(6.5)	(2.2)	(2.4)			
331 Wood and wood products	0.70 **	0.22	1.10 **	-0.04	-0.65 **	1.19 *	1.74 **	2.50 **	-0.81	2.81 **	0.89 **	1.90 **	-19.48	2.79	0.49
	(11.5)	(1.8)	(19.2)	(-0.6)	(-6.3)	(2.4)	(5.3)	(3.7)	(-0.4)	(7.4)	(3.0)	(3.1)			
332 Furniture	0.75 **	0.54 **	1.04 **	0.13 *	-0.68 **	1.36 **	1.88 **	1.69 **	-1.83	2.47 **	1.18 **	1.58 **	-24.35	2.10	0.65
	(16.3)	(6.0)	(24.2)	(2.5)	(-8.7)	(3.6)	(7.5)	(3.3)	(-1.2)	(8.6)	(5.2)	(3.4)			
341 Paper and paper products	0.73 **	-0.32 **	1.26 **	0.76 **	-0.83 **	0.59	1.70 **	2.24 **	-0.54	2.14 **	0.76 **	0.75	-21.72	2.39	0.71
	(14.0)	(-3.1)	(25.7)	(13.1)	(-9.4)	(1.4)	(6.0)	(3.9)	(-0.3)	(6.6)	(3.0)	(1.4)			
342 Printing and publishing	0.62 **	0.39 **	1.02 **	0.63 **	-0.67 **	0.71 *	1.82 **	0.62	-1.08	1.55 **	2.00 **	1.72 **	-25.54	1.73	0.77
	(16.5)	(5.2)	(28.7)	(15.0)	(-10.4)	(2.3)	(8.8)	(1.5)	(-0.8)	(6.6)	(10.7)	(4.5)			
351 Industrial chemicals	0.99 **	-0.57 **	1.40 **	0.63 **	-1.09 **	-0.42	0.80 **	0.60	-2.23	1.82 **	0.90 **	1.21 *	-18.91	2.29	0.73
	(19.9)	(-5.8)	(29.9)	(11.3)	(-12.9)	(-1.0)	(2.9)	(1.1)	(-1.3)	(5.9)	(3.7)	(2.4)			
352 Other chemical products	0.87 **	-0.05	1.31 **	0.69 **	-0.59 **	0.33	1.97 **	1.18 *	-2.40	1.41 **	1.22 **	1.70 **	-26.94	2.10	0.75
	(19.1)	(-0.6)	(30.4)	(13.5)	(-7.7)	(0.9)	(7.9)	(2.3)	(-1.5)	(4.9)	(5.4)	(3.7)			
353/4 Petroleum refineries and prod.	1.38 **	-0.49 **	0.96 **	0.46 **	-1.94 **	-0.47	0.34	-1.31	-0.58	0.98 *	1.29 **	-1.29 *	-13.44	2.88	0.60
	(22.1)	(-4.0)	(16.2)	(6.6)	(-18.3)	(-0.9)	(1.0)	(-1.9)	(-0.3)	(2.5)	(4.1)	(-2.0)			
355 Rubber products	0.53 **	0.12	1.27 **	0.47 **	-0.64 **	0.56	1.96 **	1.28 *	-0.78	2.27 **	0.51 *	1.81 **	-22.99	2.21	0.69
	(11.0)	(1.3)	(28.0)	(8.8)	(-7.8)	(1.4)	(7.5)	(2.4)	(-0.5)	(7.6)	(2.1)	(3.7)			
356 Plastic products	0.57 **	0.21 *	1.00 **	0.78 **	-0.57 **	1.00 **	2.23 **	1.18 *	-1.87	2.57 **	1.18 **	1.45 **	-24.64	2.01	0.73
	(13.1)	(2.4)	(24.2)	(15.9)	(-7.7)	(2.8)	(9.3)	(2.4)	(-1.3)	(9.4)	(5.5)	(3.3)			

Table A.4 continued

Regression results for imports of 22 OECD countries from 70 countries by product groups, 1988-90

Product groups	Y_i	y_i	Y_j	y_j	D_{ij}	ADJ_{ij}	EU_{ij}	$EFTA_{ij}$	$CUSTA_{ij}$	$APEC_{ij}$	LAN_{ij}	Col_{ij}	constant	standard error	adjusted R^2
361 Pottery, china and earthenware	0.64 ** (14.9)	0.33 ** (3.8)	1.09 ** (26.7)	0.11 * (2.2)	-0.35 ** (-4.8)	1.49 ** (4.2)	2.19 ** (9.3)	1.23 * (2.5)	-2.81 (-1.9)	2.05 ** (7.6)	0.73 ** (3.4)	0.97 * (2.2)	-24.66	1.99	0.64
362 Glass and glass products	0.63 ** (15.4)	0.08 (1.0)	1.27 ** (33.0)	0.38 ** (8.3)	-0.67 ** (-9.7)	1.13 ** (3.4)	1.90 ** (8.5)	1.03 * (2.3)	-1.87 (-1.4)	2.21 ** (8.7)	1.07 ** (5.3)	-0.05 (-0.1)	-23.42	1.87	0.75
369 Structural clay products	0.77 ** (17.4)	0.02 (0.2)	1.19 ** (28.4)	0.35 ** (7.0)	-0.81 ** (-10.7)	1.11 ** (3.0)	2.14 ** (8.8)	1.32 ** (2.7)	-1.58 (-1.1)	1.66 ** (6.0)	0.95 ** (4.3)	-0.30 (-0.7)	-22.00	2.04	0.72
371 Iron and steel basic industries	0.97 ** (16.9)	-0.33 ** (-2.9)	1.48 ** (27.2)	0.31 ** (4.9)	-1.07 ** (-10.9)	0.49 (1.0)	1.64 ** (5.2)	2.24 ** (3.5)	-2.45 (-1.3)	2.22 ** (6.2)	0.73 ** (2.6)	-0.22 (-0.4)	-21.15	2.65	0.66
372 Basic non ferrous metals	1.15 ** (17.8)	-0.38 ** (-3.0)	1.10 ** (18.0)	0.46 ** (6.4)	-0.76 ** (-6.9)	0.76 (1.4)	1.26 ** (3.6)	2.09 ** (2.9)	-1.14 (-0.5)	2.01 ** (5.0)	0.43 (1.4)	1.10 (1.7)	-21.84	2.98	0.54
381 Fabricated metal products	0.80 ** (17.8)	0.08 (1.0)	1.33 ** (31.6)	0.53 ** (10.6)	-0.73 ** (-9.6)	0.52 (1.4)	1.67 ** (6.8)	1.54 ** (3.1)	-2.42 (-1.6)	1.99 ** (7.1)	1.41 ** (6.4)	1.49 ** (3.3)	-25.31	2.06	0.75
382 Machinery (excl. electrical)	0.84 ** (19.3)	-0.13 (-1.5)	1.32 ** (32.0)	0.97 ** (19.9)	-0.88 ** (-11.9)	-0.26 (-0.7)	1.03 ** (4.3)	0.82 (1.7)	-1.93 (-1.3)	1.90 ** (7.0)	0.99 ** (4.6)	2.68 ** (6.1)	-24.68	2.01	0.80
383 Electrical machinery	0.76 ** (14.8)	0.17 (1.7)	1.28 ** (26.6)	0.82 ** (14.3)	-0.75 ** (-8.7)	-0.14 (-0.3)	1.38 ** (4.9)	1.03 (1.8)	-1.98 (-1.1)	2.47 ** (7.7)	0.84 ** (3.3)	2.64 ** (5.1)	-26.24	2.35	0.72
384 Transport equipment	0.80 ** (16.6)	0.06 (0.7)	1.42 ** (31.4)	0.76 ** (14.1)	-1.01 ** (-12.5)	0.09 (0.2)	1.20 ** (4.6)	0.39 (0.7)	0.21 (0.1)	1.50 ** (5.0)	0.72 ** (3.0)	3.44 ** (7.1)	-24.99	2.20	0.76
385 Measuring, photogr.,optical etc.	0.78 ** (16.8)	0.02 (0.2)	1.14 ** (25.8)	0.90 ** (17.3)	-0.51 ** (-6.4)	0.36 (0.9)	1.31 ** (5.1)	0.94 (1.8)	-1.77 (-1.1)	1.68 ** (5.8)	0.83 ** (3.6)	3.16 ** (6.7)	-27.12	2.15	0.73
390 Other manufacturing industries	0.88 ** (16.9)	0.55 ** (5.3)	1.21 ** (24.6)	0.33 ** (5.7)	-0.32 ** (-3.7)	0.47 (1.1)	1.67 ** (5.8)	1.05 (1.8)	-2.92 (-1.6)	1.83 ** (5.6)	1.09 ** (4.2)	1.34 * (2.5)	-30.97	2.40	0.63

Note: ** indicates significance at 99 % level, * indicates significance at 95 % level. 1505 degrees of freedom.

Source: Own calculations, for method see text.